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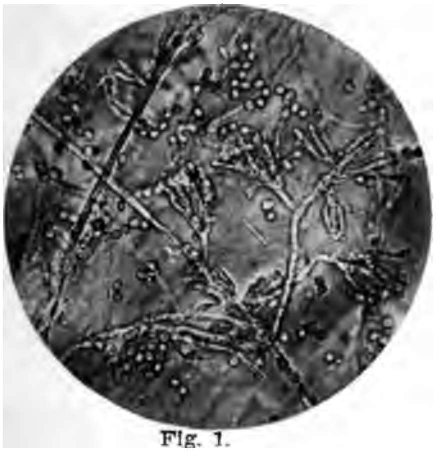
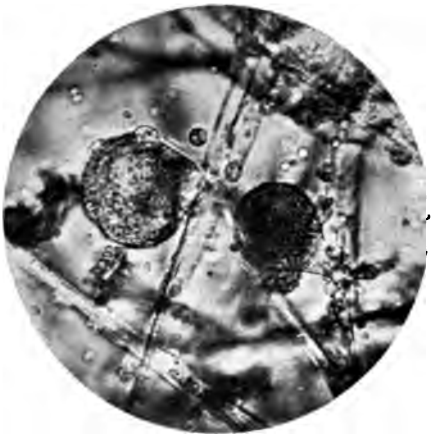


Fig. 1.



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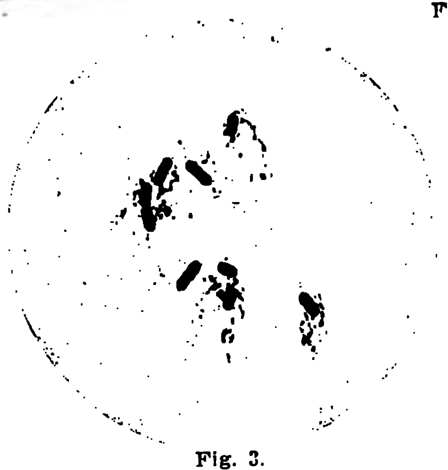

Fig. 3.

Fig. 4.

Fig. 5.

MICRO-ORGANISMS THAT PRODUCE POISONS IN FOODS.

(See pages 12, 13).

FOOD PRESERVATIVES

THEIR

ADVANTAGES AND PROPER USE

THE PRACTICAL VERSUS THE THEORETICAL
SIDE OF THE
PURE FOOD PROBLEM

BY
R. G. ECCLES, M.D., PHAR.D.
FELLOW OF THE AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE;
MEMBER OF THE AMERICAN CHEMICAL SOCIETY; CHAIRMAN OF THE SUB-
COMMITTEE ON ACTIVE PRINCIPLES AND FERMENTS OF THE UNITED
STATES PHARMACOPOEIA (1890 TO 1900); VICE-PRESIDENT OF
A WASHINGTON PURE FOOD AND DRUG CONGRESS

WITH AN INTRODUCTION BY
E. W. DUCKWALL, M.S.
MEMBER OF SOCIETY OF AMERICAN BACTERIOLOGISTS; MEMBER OF AMERICAN
ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE; MEMBER
OF THE AMERICAN CHEMICAL SOCIETY

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PREFACE.

THE use of preservatives in perishable foods is probably much older than civilization. Salt and smoke are used even by savages to prevent decay in stored provisions, particularly in climates that are damp and where drying is an insufficient protection. Alcohol, vinegar and sugar are preservatives that came into use at a later date. They were all, however, used in pre-scientific times and before the race knew anything about bacteria, about the causes of fermentation, or of the nature of the changes that take place during the decay of organic substances. Modern science, through its methods of experimental research, has shown us just how the old type of preservatives are able to preserve, and has supplied the world with, what the author believes to be, better substances with which to combat many forms of decay in provisions. Unfortunately there are in the world a large number of people who dread changes of every kind and who have a particular dread of any change connected with what they eat and drink. Conservative people often acquire strange notions about what ought to be deemed wholesome and what unwholesome, what should be eaten and what eschewed. People of one nation will enjoy as most relishable articles of diet substances which those of another nation will turn from in disgust and alarm. That there should be opposition to the using of modern food preservatives is, therefore, not at all surprising, since their use antagonizes old ideas and upsets old habits at an extremely sensitive point. When self-interest prompts another class to the possessing of a burning desire to favor the notions of the conservative, to appear as public benefactors, and to show themselves as efficient guardians of the trusts that have been imposed upon them, it is easy to see how the combination is likely to work without either side feeling that they are in the slightest degree swerving from the direct lines of duty. We have not the slightest desire to charge upon either the conservative or the dutiful official any motive that is not thoroughly honorable and upright. We are conscious of the honest intent of both, but we deprecate, just the same, a result which we deem unfortunate and antagonistic to the best interests of humanity.

To us it seems unreasonable to believe that savages could have discovered the only really safe preservatives in the universe. To even acknowledge that they discovered the best food preservatives that nature can provide seems contrary to all analogy. That modern science, after years of special study in this very field, should emerge from its work beaten and baffled, and be compelled to acknowledge that Apaches, Bedouins, Tartars, and Mongolians had wrenched all the prizes from them before they began their research, requires a very great stretch of credulity. And yet, incredible as it may seem, is this not exactly what we are forced to concede, if the claims of the opponents of modern preservatives are correct? They insist upon it as a fact that the only safe food preservatives are the ones handed down to us from the barbarous and ignorant past. They are willing that these shall be legalized, but they seek to prohibit the use of more modern ones, notwithstanding the fact that there are indications that the latter may be the ones that infinite nature has chosen to protect from decay the delicate pollen of flowers and seeds of some plants.

Twenty years ago the author of this volume, while engaged on research work on the use of antiseptics as preservatives of medical solutions (Proc. Amer. Pharm. Assoc., 1885, p. 429), was much impressed by the antagonistic attitude of Brouardel (Drug. Circ., July, 1884, p. 105), Hilgard (Rep. of Viticultural Work, 1883-4, p. 32), and others, toward what he had experimentally found to be a most excellent and apparently harmless preservative. It seemed that if to use this substance in wines and foods was as serious a matter as claimed, it might be of doubtful propriety to use it in unstable medical solutions. Not wishing to do anything that might misdirect the public, a careful study of the facts on which the objections were claimed to be urged was at once begun. In the meantime a substitute for the condemned article was required, and after a long series of experiments it became apparent that, next to the condemned article, benzoic acid and its salts were the most efficient preservatives that could be used. It was particularly desirable that a substitute should at that particular time be found, as American food commissioners, in imitation of the French, had begun a lively crusade against the use of salicylic acid. When the author first advocated the use of benzoic acid as a preservative, it was with the full knowledge of its being a less desirable preservative. It was proposed merely in deference to a false public sentiment which a few Frenchmen had, for political reasons chiefly, stirred up. After publishing the facts regarding the power of benzoic acid, it was over five years before it began to meet with general favor. Not until after the appearance of the second edition of "Thorpe's Dictionary of Applied Chemistry," in 1891, did much attention appear to have been taken of the matter. When the first volume of this dictionary appeared its reference to the claims of this author, on page 288, would seem to have attracted considerable attention, as very quickly thereafter the reports of food analysts began to tell of its presence in foods and beverages.

After the literature of the condemned preservative had been fairly studied by the author, the outcome was one of profound skepticism toward every objection that had been urged against it. Not an iota of experimental evidence could at that time be found that supported a single one of the claims that had been urged against it. In every instance they based their opposition upon theories that were even then of very questionable validity, and which time and progress have since thoroughly discredited. A significant fact that was attached to the denunciation lay in the character of its origin. It started in a country whose people had but a short time before been badly vanquished on the battle-field, and where the rankling venom of political hatred was turned upon everything that had its origin among the conquering people. As this preservative was a product imported from the country of the conquerors, it naturally came in for its share of the general dislike. The indications seemed to point to the conclusion that political passion had usurped the place of scientific dispassion in dealing with it. No good thing could come out of such a Nazareth seemed to be the burden of their belief.

In 1885-6, while conducting a series of experiments upon the effects of medical substances on peptic digestion, the author was again brought face to face with the problem of preservatives. (Proc. Amer. Phar. Assoc., 1886, pp. 83 to 103; *New York Medical Journal,* Nov. 27 and Dec. 11, 1886.) As the belief nineteen years ago was almost universal that what hindered putrefaction must hinder digestion to a similar extent, because both were considered forms of fermentation, the publication of results contrary to this supposition caused surprise to a number of readers. It set at rest, so far as the author was concerned, this particular phase of the subject, and, as experimenter after experimenter has since confirmed the results then given, it has been a pleasure to watch the changing attitude of scientific men in this direction. Lafar now says: "It has long been known that antiseptics in small doses exert no injurious influence on the action of enzymes." (Technical Mycology, vol. I., p. 300.) There are still a few who cling to the old idea and urge it as a sound reason for repressive legislation against modern preservatives. The tenacity of time-honored errors is proverbially great, and the author must confess that he was loath to give up the idea that there was some slight connection between antiseptic power and the hindrance of enzymic action. Only through a later critical analysis of the results did disillusion come. The experiments showed that all sorts of substances, regardless of antiseptic power, had a retarding influence on peptonization, when used in quantities large enough. Indeed, the most potent inhibitors were such as had little or no antiseptic power. Had such research work been continued, it is pretty certain that an active part would have been taken years ago against those who have so actively fought food preservatives on so untenable a ground. For nearly a decade every spare hour of the author's time, aside from professional duties, had to be devoted to the study of active principles, enzymes, and synthetic remedies, for the United States Pharmacopœia. Until the recent excitement due to pure food congresses and Parliamentary and Congressional investigations began there was little to stimulate further interest in the subject of food preservatives. While serving as vice-president of the Washington Pure Food and Drug Congress of 1900, it soon became apparent that the author's sympathies were not in accord with those of the majority of the leaders of that movement in the matter. While heartily in favor of pure-food legislation, the opposition to modern preservatives seemed to be in favor of impure food and foods dangerous to public health. In order to overcome what is believed to be an erroneous conception of the subject, as at present entertained by many pure food advocates, the present volume has been prepared. It is put forth with the hope that it may direct food commissioners, legislators, health officers, physicians, and sanitarians generally, to a full appreciation of the fact that the evils that come from not using preservatives may be greater than those that can possibly result from their use. ROBERT G. ECCLES.

191 Dean street, Brooklyn, N. Y.

INTRODUCTION.

THE SCYLLA AND CHARYBDIS OF THE PACKING INDUSTRY.

HAVING been actively engaged in the manufacture of Food Products for years and having studied the actual requirements of the Food Packing Industry, I have no hesitation in saying that the crusades that are being waged against the use of preservatives in some States is a matter to be regretted by all serious-minded men. Without wishing to appear as a special advocate for the general use of antiseptic substances in food, it would be a great satisfaction to me if some of those who oppose their use would point out a safe method of packing certain perishable articles in a way to protect the public health without them. The manufacturers are anxious to abide by the laws, but they are likely to be driven out of business by their inability to please their customers, save the lives and health of these customers, and at the same time do as food commissioners demand. They cannot reconcile the irreconcilable. Customers demand food products with proper flavor, proper appearance, proper keeping qualities, and that contain no poisonous substances resulting from decay. State chemists and food commissioners, inexperienced in the details of the packing and canning business, declare that manufacturers shall not, if they can prevent it, use the only means at command to supply goods having the qualities mentioned.

The State officers have been asked to tell the manufacturers how customers can be protected, and likewise pleased, with goods that satisfy these officers, but no reply is returned, except threats of fines and imprisonments. There are a number of table condiments which do not keep well unless a preservative is added. Among these may be mentioned tomato catsup, chili sauce, tomato chutney, apple butter, peach butter, preserves, jellies, jams, marmalades, etc. The tomato condiments require one part in seven hundred and fifty of such preservatives as salicylic acid, or some salicylate, benzoic acid, or some benzoate, while for the others only from one part in one thousand to one part in two thousand is needed. Where canned goods have been bleached with sulphites and the colors have been restored with copper salts and coal-tar dyes, I have suggested that the canners be brave enough to cease using these substances, and state to the buyers of their goods that the appearance and flavor are the best that can be produced without resorting to artificial and unnecessary means. Where waste of money and waste of material through spoilage, and where health, or even life, may be sacrificed from the same cause, it becomes simply impossible to give advice, under existing conditions of legislation, that will conform to pure-food laws, so called.

Many people imagine that home-made goods are equal to, if not the superiors of, the best put upon the market by manufacturers, and, since these get along without preservatives, they cannot see why all other goods should not. The truth of the matter is that home goods are seldom equal in quality and flavor to those put out by the best manufacturers. First-class manufacturers, as a rule, use only the choicest raw materials. In many instances they make special contracts with growers that no goods are to be delivered that are not in every particular strictly first class. Most manufacturers have perfect outfits of modern machinery, the advantage of steam for cooking, the most skilful employes that are obtainable, and other advantages that the home-worker cannot command. Why should he not be able to produce superior goods? The maker of home-made goods must be content with such fruits and vegetables as are delivered to her at the time she is ready to do the work, has only crude methods of doing the work, must be content with the uneven temperature of an ordinary fire, has to use packages that are often defective, and the work and worry are frequently augmented by inexperience, lack of skill, and want of trained judgment. Home-made goods, after having been sealed and put away, remain a relatively short time unconsumed, and when away from the table are undisturbed. When brought forth from their resting place, should they be mold-covered or bacteria-invaded no complaints are entered. The mold is carefully removed and the goods consumed even if the flavor is spoiled. The bacteria-invaded packages are considered spoiled, by nobody's fault, and thrown away unmurmuringly.

How about the goods from the manufacturer? Let mold appear on the surface of his goods, let the flavor be imperfect, let the color seem unnatural in any way, and how quickly they are returned to the grocer. How the condemnation grows until it is magnified into a mountain of objections to the brand, when the manufacturer gets back his rejected goods and the complaining letter. Goods that are marketed must be pure and unfermented, they must have no covering of mold, and they must show no mark that suggests carelessness or inferiority. Such goods are not permitted to stand quietly on a closet shelf until they are wanted upon the table. They must be hauled on wagons, shipped in cars, loaded on steamboats and turned and shaken by a multitude of handlers while being transported over many miles of country to their final destination. In these wanderings they are subjected to many vicissitudes of temperature. After all this they must reach their destination in first-class condition. What this signifies is painfully obvious to the bacteriologist and to the experienced packer but not to ordinary business men. Home-made goods could not possibly stand such treatment. They would spoil on reaching the shelves of the grocer.

While ordinary cooking in open vessels destroys the molds and yeasts that are present in the goods, it does not destroy the molds or other fungi that occupy the air spaces at the tops of jars or other containers into which such goods are poured. Mold is a minute plant which starts from a spore or seed called a conidium. A favorite place of growth is on food products that, like tomatoes and fruits, are slightly acid. It requires large quantities of oxygen in its typical form, so that it is most frequently seen covering the surface of nutrient substances. A single conidium falling on such a surface soon sends forth thread-like filaments that branch into a netted mass that is called a mycelium. From this arise slender stalks or hyphæ, on the summit of which develop a multitude of new conidia, or seed, which, in turn, pursue the same cycle of growth. Soon the whole surface is covered with these tiny plants. When mold grows in this way it does not cause fermentation. It even acts for a time as a surface protection from invading bacteria. If it always grew in this manner but little harm might result from it. Mold, however, has another form of reproduction, and in this form it is responsible for the spoilage of a large amount of perishable foods. When the conidia are submerged or forced down below the surface of a nutrient substance they assume a new form of growth known as gemmation or budding. In this form, being unable to get their oxygen from the air, they manage to secure it by decomposing the carbohydrates of the food in which they are submerged. In appearance and manner of growth they so closely resemble yeasts that it requires familiarity with them to distinguish the difference. In thus decomposing food they produce such substances as alcohol, carbonic acid, succinic acid, glycerin, fatty acids, and a phenol-like substance. The changes produced are rapid, and if a large number of conidia are submerged favorable conditions of temperature may cause the fermentation to be quite violent. Imagine, therefore, what would happen to home-made goods if subjected to the conditions incident to transportation. Let such packages be turned upside down and shaken several times during the journey and the conidia that had before occupied the air space at the top of the jar, where they remained dormant, are now mixed up in the product to set up active fermentation. It is not possible to boil down fresh tomatoes into catsup, chili sauce, and chutney, bottle them hot, cork and ship them from one place to another, unless the bottles are sterilized after being corked, or a preservative is added. The conidia of molds are not destroyed instantly at boiling temperature. It is surprising to note that they will sometimes grow after several minutes exposure to 212° F. Home-made goods are not sterilized and, as a consequence, it would be impossible for them to endure the conditions to which marketed goods are constantly subjected. It is also a well-known fact that they lack the fine flavor possessed by those produced by manufacturers. This flavor is obtained by boiling down selected stock *very rapidly.* Slow boiling kills the flavor. It is not uncommon for tomatoes to be turned into finished catsup within one hour after the fresh, and therefore most richly flavored stock, is received. The housekeeper receives no such stock, and has not the appliances for rapid cooking, such as is necessary, in order to retain the flavor, even of the inferior stock that comes into her possession. Home-prepared goods, as a rule, are left to simmer over a slow fire for four or five hours. Bottled condiments can be sterilized so that they will keep in an unfermented condition for an unlimited time, but the heat, necessary to insure perfect sterilization, destroys much of the delicate flavor. What is to be gained by thus damaging the goods? A small amount of a preservative would make them keep as well and would not injure the flavor.

Then, too, private families usually purchase pints or quarts and occasionally half pints. They intend that such a quantity shall last them for a week or more. As everybody knows, condiments are used sparingly on meats, fish, oysters, etc., and not consumed in large amounts like ordinary articles of food. Sterilized goods when once opened are immediately exposed to invasion by molds, yeasts, and bacteria from the air. These are shaken up in the condiment every time the bottle is turned over to pour out a portion. The mold conidia, the yeasts, and the other fungi, are thus submerged so that fermentation and cleavage processes begin at once. It is not uncommon to see the bottles left uncorked, or loosely stoppered, so that the gases escape and the rotting and decomposition go on for days *unperceived* by the users. There is no questioning of the fact that large numbers of people go on, day after day, eating just such unwholesome materials, not knowing that they are swallowing millions of micro-organisms and quite frequently toxic substances or ptomaines which have been excreted or formed. Without doubt people will unwittingly continue to eat these things so long as manufacturers are not permitted to supply them with the kind of goods they so much desire to buy. The manufacturer, while catering to the public taste, conserves the public health. The so-called advocates of pure food, that is not pure food, endanger the public health and will not permit the people to secure from the market the kind of goods that they prefer to purchase. The manufacturer might supply families with condiments put up in containers holding only enough for a single individual, to be entirely consumed at a single meal. They could likewise put upon the market packages containing enough for a family of two or more persons. Think, however, of the hardship which this would entail upon the poor, by compelling them to waste so much money on containers, and the extra labor involved in putting them up. Think, likewise, of the fact that the goods costing so very much more being decidedly inferior in flavor to the less costly and much more convenient.

Food of any kind is far from ideal when allowed to ferment or decompose. The repulsive odor, the unpleasant flavor, and the changed appearance, are all signals of danger. Even ordinary blue mold, the Penicillium glaucum of the botanist, when growing in yeast form, is said to evolve "a phenol-like body which in large doses produce headache, vertigo, and even impaired sight." (Bull. 13, Dept. Agric., Div. of Chem., p. 1335.) Fig. 1 shows its appearance when magnified. Like many bacteria, while ordinarily deemed non-pathogenic, under changed conditions it may become dangerous. The greatest danger from molds is probably lodged in pathogenic species, such as Aspergillus fumigatus. Its appearance to the naked eye is very much like that of common green mold. It is not so common, however, and that is fortunate, because of its harmful nature. The conidia, if injected into the veins of rabbits or dogs, will cause their death. Not long ago I was called upon to examine the sputum of a man supposed to be suffering from tuberculosis and who later died from his affliction. I found no tubercle bacilli but instead of them an abundance of the conidia of Aspergillus fumigatus. This mold will cause the fermentation of preserves and tomato products on which it will grow luxuriantly. The conidia are exceedingly small, being only about half the size of those produced by some other species. By reason of its dangerous character it would seem to any thinking man that foods which are continually subjected to conditions favorable to decay should be protected from the development of forms like this. Fig. 2 is a photomicrograph which shows its appearance when magnified. Small as it is the bacteria are still smaller. Some forms of the latter are very virulent while others are relatively harmless. They are almost universally present in the air and contaminate the surfaces of foods at every exposure. These germs are so small that when magnified one thousand diameters they would appear only as large as the letter "l" in print, or, if the magnified breadth were multiplied by the magnified length, it would give a total magnification of about one million. Some of those called micrococci, when magnified one million times, or twelve hundred diameters, would appear no larger than a (" . ") period. Our microscopes have been brought up to such perfection that we are able to see these minute organisms very easily. We can get some idea of the size of these if we compare the ordinary man with one magnified as much. A man of six feet, if magnified one thousand diameters would be over one mile high, and about one-third of a mile broad across the shoulders, and he would present a surface as large as a million ordinary men. Fig. 3 is the photomicrograph of a rod-shaped bacterium from a can of spoiled peas that was sent to me for examination by a manufacturer. The thread-like appendages seen on each are known as flagella. These are their organs of locomotion. Figs. 4 and 5 are photomicrographs of bacteria from cans of spoiled corn and mincemeat, respectively, that were likewise sent to me for investigation by different manufacturers.

Figure 5 produces a poisonous ptomaine. Its numerous flagella I succeeded in bringing out with striking distinctness, by special staining methods, aided by the best magnifying lenses that I have been able to secure. The photograph was taken from a specimen obtained from a pure agar culture eight hours old. A one-twelfth homogeneous oil immersion lens and acetylene radiant were used. It was magnified 1,200 diameters.

Figure 6 is Bacillus botilinus. This is the anaerobic spore-bearing bacillus which recently caused so many deaths from the eating of bean salad at the Cooking School, at Darmstadt, Germany. Dr. Eccles refers to this tragedy in the next chapter. If the spoilage, the rich flavor, and the perfect appearance of marketed goods of the kind we have been considering, are to be preserved, and if the health and lives of consumers are to be protected from dangerous micro-organisms, then a limited use of modern preservatives is a necessity. Such goods as are never likely to be consumed at a single meal, that are only used in small amounts at any one meal, and that are subject, while being used, to forms of decomposition that are often detrimental to health, should surely be protected by preservatives. It is unlikely that an excess will ever be used because the expense will be too great for the manufacturer to wastefully add more than enough, and the unpleasant flavor which an excess produces would injure the sale. Manufacturers aim at using only such preservatives as are entirely harmless in the amounts added. In the class of goods to which I have referred salicylic and benzoic acids, or their sodium salts, have been chiefly used.

In order to ascertain, experimentally, whether or not these preservatives are harmless I began on salicylic acid. In *Trench's Canners' Index,* for May, 1904, I have published a photograph of a number of guinea-pigs which were being fed weighed amounts of salicylic acid in their food. Mixing 7½ milligrams of the acid in a breakfast cereal with milk this amount was fed daily to each pig. It was soon evident that only hunger would force them to take such food because of the flavor of the acid. The amount was therefore cut down to 5 milligrams to the same amount of food. It is thus seen that even guinea-pigs will reject food that contains more than a preserving and perfectly safe quantity. The only food taken by the pigs outside of this prescribed diet was grass, which was fed to them liberally. Comparing the weight of a guinea-pig with that of an average man, which is as 1 to 100, or 1 to 150, the same proportion of acid would be from 7½ to 10 grains daily for a man, and this amount of preservative would be sufficient to inhibit the growth of micro-organisms in 16 to 24 ounces of solid food in proportion of 1 to 1,000. This amount of preservative is far in excess of the amount taken in food daily by any person. In choosing the kind of animals to be used in these experiments certain facts bearing upon the results had to be taken into consideration. There are no animals which live on a diet exactly the same as human. It would not do to choose such as feed on partially decomposed materials, as do the dog and cat, because the stomachs of such animals are not as sensitive to poisonous or injurious substances as is the human. The stomach of the guinea-pig is sensitive to poisons and cannot tolerate certain kinds of foods. Even milk is not properly digested by them unless it is mixed with cereal. As nearly all the food products in which salicylates and benzoates are used happen to be of vegetable origin this also gave a fitness to the choice of the guinea-pig rather than a carnivorous animal. The guinea-pig is a herbivorous animal, costs but little, is easily handled, is not very large, and so every advantage may be claimed for the selection. The first series of experiments began on May 14th and lasted till June 15th. Three guinea-pigs were used, one of them being fed its natural food during the entire time so that it might control the results gained from the other two. The weights were taken every second day. All the animals seemed healthy and active during the entire period. There was an increase in weight for all three up to May 30th when, for some unaccountable reason, they all lost weight. This was regained, however, five days later. This decrease in weight was true of the control, as well as of the others, showing that the salicylic acid was not the cause. In the thirty-one days their respective gains in weight were 5½ ounces, 5 ounces, and 3¼ ounces. The last was that of the control, but it only covered 24 instead of 30 days' time. All three animals were now sent for examination to Dr. W. H. Ingram, professor of pathology in the West Penn Medical College, of Pittsburg. His report covers pathological analyses of their fat, lymph glands, muscle, stomach, intestine, liver, gall-bladder, pancreas, spleen, kidneys, suprarenals, bladder, mesentery, thoracic cavity, lungs, etc. He found no evidences of inflammation or degeneration in any of the parts. Every organ and every tissue he pronounced normal in every essential. His own concluding words are: "The conclusion to be drawn from these sections, after careful comparisons, would be that all three animals were in a healthy condition, and that whatever diets may have been administered, they had no effect on the various organs, so far as any structural alterations were concerned. I could not detect any evidence, either of a degenerative, inflammatory, necrotic, or hyperplastic process." This experiment with animals was followed by others and the effects of different preservatives were carefully studied. So far as my researches have gone, covering four series similar to the one described, there is a very strong indication that preservatives, in moderate amounts, have no injurious effect on any internal organs. A full report of these experiments, and a complete copy of Dr. Ingram's findings can be found in *The Canner and Dried Fruit Packer*, of August 4, 1904, pp. 40 to 43, and the following numbers up to December 1st. In view of all the facts it certainly seems as if the danger from preservatives, such as we have mentioned, is incomparably less than the danger from toxic products formed by bacteria and molds.

EDWARD W. DUCKWALL.

Sprague Canners' Laboratory, Aspinwall, Pa.

FOOD PRESERVATIVES

Their Advantages and Proper Use.

CHAPTER I.

WHY PRESERVATIVES ARE USED IN FOODS.

WHILE most people are familiar with the fact that the decay of perishable food is associated with conditions that are a menace to public health, few fully realize the greatness of the danger, the frequency with which serious and even fatal accidents of this kind occur, nor the terrible character of the agony which the victims have to endure. So common are they that all works on the practice of medicine refer at considerable length to them. Medical journals make no attempt to chronicle events of this kind because of their great frequency. It is only in unusual cases, or cases containing some unusual character, that they are referred to. They are treated just as cases of other kinds of disease of common occurrence. It is in the newspapers that one must look to get the records of the majority of such cases. Even here those of local occurrence, unless startling in character, are not all referred to. During the year 1903 the following found their way into the columns of the New York daily papers:

(1) A night watchman at Mount Morris Park grew suddenly ill and died soon after eating decomposed oysters. Investigation showed that the oysters were the cause of his death.

(2) Michael Lally, of Dorchester, Mass., after eating sardines in a New York restaurant grew suddenly and violently ill.

The nature of his symptoms and a study of the case seemed to fix the blame upon the sardines.

(3) Fifty guests at Senator Stewart's Virginia stock farm were taken suddenly and violently ill after eating cold-storage beef. The symptoms were those of ptomaine or toxin poisoning.

(4) Seidl, the celebrated orchestra conductor, died in New York, after eating fish, under conditions that were reported by his medical attendants to be those of ptomaine poisoning.

(5) The Kaplan family, immediately after eating corned beef sandwiches, at Rockaway, were taken violently ill with the symptoms of poisoning by toxins.

(6) Twelve persons, at the Ayres Home in Metuchen, were prostrated with the symptoms of meat poisoning, after eating some roast beef.

(7) Miss Harjes, daughter of a Paris banker, was suddenly prostrated with toxic symptoms after partaking of some canned meat.

Food poisons do not develop during cold-storage. It is either *before* or else *after* that the trouble arises unless there has been a period of removal from such storage. Sterile canned goods do not produce them. It is either *before* or *after* sterilizing that they develop. The number of cases of food poisoning are few as compared with the total food supply consumed, but they are entirely too frequent. Exposure to the dust in the air is a common means of germ sowing. A few hours left at ordinary temperatures does the rest. The housemaid, cook, or wife, failing to put the left-over provisions in the refrigerator *immediately,* or, having run low in ice, does not keep them cool enough, becomes the medium for disseminating suffering and death at the home end of the line. How can they be taught to protect the health and lives of family, friends, and guests when they have no ice or when there is an insufficient supply in the house?

Provisions of every kind are *occasionally* subject to exposure and delay *before* being placed in cold-storage and before being canned. A Saturday supply is held over till Monday when in excess of the amount that can be properly cared for by the help on hand. An accident occurs to the refrigerating plant and a mass of perishable provisions must remain hours and, perhaps, days uncanned. Dead poultry are shipped in open vehicles, and meat is carried in the same way, for what is intended to be a short time. There is a break-down, or the driver has been hurt, or some other unforeseen cause of delay occurs and the goods are kept long enough out of cold storage for serious infection to occur before canning. What should be done with these goods? As they have not reached the stage of showing marked decay the owners will not throw them away, however earnest we might be in insisting that they do so. Laws and penalties would be futile in the majority of such instances. Would it not be the part of prudence to insist upon some simple plan of protecting such goods, under such circumstances, from becoming carriers of suffering and death to multitudes? Is there no plan of saving such goods from deteriorating to the danger point, immediately on discovering that they can neither be canned nor stored in ice until such deterioration has occurred? Should not something be done to keep them fresh rather than compel the owners to dispose of them in a stale and dangerous condition? Or is it better to have our newspapers kept busy chronicling events like the following: "A medical inquiry is being made into a strange case of a number of girls belonging to a cooking school in Darmstadt who were poisoned recently by eating salad made from canned beans. Seven of the girls are dead and six are dying."

This press telegram from Berlin appeared in the New York papers of January 30, 1904, and gives point to the preceding questions. In this case we see that canned vegetables can become as dangerous as canned or cold-storage meats. It also gives us evidence of the fact that the poison did not develop after the cooking, but existed in the canned beans before they were opened. Being a typical case of its kind the *Darmstadter Taglicher Anzeiger,* of February 9, 1904, giving the verbatim report of the government examination into the case was obtained, and the following translation transcribed: "From a consideration of the course of the illness, and of the condition of the corpses, it must be assumed that the fatal bean salad contained a poison, developed in it just as in the case of that formed in meat and sausage by the well-known bacterium, Bacillus botilinus, discovered by Ermenghem, of Ghent. The investigation was hence begun by testing for poisons the remainder of the bean salad. This was contained in an ash pail, and was placed at my disposal by Dr. Fischer, Director of the Stadischer Krankenhause, of Darmstadt, on January 28th. Investigation showed that the beans, which were covered with a light coating of cream, contained an exceedingly dangerous poison for mice and guinea-pigs, and which was active when introduced into either the subcellular tissue or the abdominal cavity. On the 20th of January there were sent me two empty cans, together with an unopened can, weighing about one and a half kilos, of the wax beans, such as had been used in the cook school. The can was provided with a rubber ring and cover, the latter being held fast by a curved spring. A little of the fluid had oozed out during transportation, and in spite of the closure, gas bubbles found their way out. The unopened can bore external evidence, therefore, that the contents had undergone decomposition, with the formation of gases. The can diffused a nauseous, rancid, butyric acid-like odor, as did also the remainder of the beans in the ash pail. On opening the can it was found that the beans, though somewhat soft, were nevertheless well preserved in a slightly turbid, very rancid, weakly acid liquid free from any putrid odor, and easily clarified by filtration. Experiments made on animals showed that the contents of the can were equally as poisonous as the remainder of the beans in the ash pail. This facilitated the investigation, as it rendered it unnecessary to consider the cream which was used in preparing the bean salad, as a source of poison. The assumption that but one of the cans used contained the poison is untenable as it is pretty certain that at least two, if not all the cans taken had undergone like decomposition. To demonstrate the exceedingly high toxicity exhibited by the contents of the case, I will here detail one of the experiments made. Three healthy rabbits, weighing respectively 2,020, 2,350 and 1,680 grams, each received a subcutaneous injection of the perfectly clear, filtered liquid from the beans. The first received 0.5 Cc. of the undiluted liquid; it died in 19 hours, after exhibiting salivation, general tendency to falling, and slight spasms. The second received 0.05 Cc. of the liquid, previously diluted with physiological salt solution; it died in 36 hours. The third animal received—after still further dilution—0.005 Cc. of the liquid, corresponding to 5 milligrams of the liquid from the beans. On February 2d this animal was still well, but became sick on the third, and this morning was found dead, *i. e.*, about

60 hours after the injection was made. The smallest fatal dose for adult rabbits is hence still below 0.005 gram of the liquid holding the beans."

The charge is frequently made that the canners could put a stop to the decomposing of the contents of closed cans if they would select good, pure, raw materials for packing, maintain strictly clean conditions around their works, and sterilize or pasteurize in the usual methods. What sort of explanation would these people make of the following from *The Canner and Dried Fruit Packer,* of August 4, 1904, p. 36?

July 6, 1904.

Prof. E. W. Duckwall, care of Sprague Canners' Laboratory,
Aspinwall, Pa.

DEAR SIR: We are sending you by express to-day, charges prepaid, a box containing six cans of peas. These were absolutely fresh stock, shelled, cleaned, filled and processed without delay, and cooked under ten-pound pressure twenty-five minutes after the glass shows 240°; then cooled and stacked in cases. The swelling shows about a week after being cooked, and seems to be very general, from present appearances, perhaps one-fourth of the pack. We have, on noticing this condition, increased our cook to fifteen-pound pressure, or 250°, and find that we have the difficulty stopped, but we are at a loss to understand the conditions that existed in the first two weeks' pack. We have cooked our peas for the past three years at the ten-pound pressure, and from twenty to thirty minutes, and have had no trouble of any moment. This was, too, when our factory was crowded, and the peas did not go through the process as promptly as they have this season. Also, when they had to be delayed in threshing other seasons on account of excessive deliveries; in fact, all the conditions in our factory this year are 25 per cent. better than they have been."

In the report from which the above is quoted Professor Duckwall states that "the six cans arrived, three of them bursted and contents gone. The odor was very bad, showing that putrefactive bacteria had accomplished the spoilage. The three remaining cans were badly swelled, and when punctured the force of the gas caused the juice to spurt out in a stream." The professor next goes on to describe his bacteriological examinations of the contents of the cans and the conditions he found. In view of the fact that we have here almost a duplication of the essential conditions which caused so sad a sacrifice of life at Darmstadt, it is interesting to notice the statements of the canner regarding his product. His wise care in discovering the condition of his goods before he had shipped them may have saved some American family a repetition of the horror of the German cooking school. Indeed, a multitude of families might have suffered, not all, perhaps, to so extreme a degree, but many of them in lesser amount. Even if the bacillus was not the same, a merely putrefactive one might have caused some considerable discomfort and illness. But how did it happen that this packer produced cans that broke down in this manner when the conditions of his cannery were superior to those of preceding years when no such decomposition occurred in the goods he had produced? How was it that with stock of a superior grade this thing should happen, when it had never before happened when less care was taken? Professor Duckwall explains it thus: "Absolutely fresh stock has more resistant spores than raw material which has been exposed for a limited time, and will therefore require a little higher temperature to insure perfect sterilization." It is thus seen that the better and drier the peas the greater is the danger. The desire of the packer to get for his customers the very best goods he could secure led to the danger. Had the peas been less fresh they would have had a chance to "sweat" a little, and so have advanced the spores to a condition where they would not resist the sterilizing power of the usual sterilizing temperature. But here develops another danger. If kept still longer in the "sweating" condition lactic acid will develop and the peas become sour. Should alkaline conditions exist, or other conditions unfavorable to lactic fermentation, putrefactive or even disease germs may develop and go on to their sporing stage. It does not take long for spores to dry and become resisting. Over-long keeping under the conditions named might produce an intensified form of the dangers, incident to the too fresh condition. Here we see how extremes may meet in the life cycle of the poison-producing germs. Short delays of the ordinary type may, and really seem to, favor public health, but long ones either produce souring or dangerous putrefactive changes. When break-downs of machinery, strikes, long transportation delays, from any cause, or the forcing into a region more of a certain class of goods than available help can dispose of, the inevitable result is danger to the users of such goods. Would it, or would it not, be a benefit to the community to have all such goods treated to preservatives before they have had time to deteriorate? In this way they could be disposed of quickly, economically, and safely. If packed by themselves, put upon the market as preservative-packed goods, and bearing the name of the preservative used, why should any person object to so simple a plan of saving multitudes from agony and death?

Surely no one can seriously contend that the almost weekly recurrence of cases of severe ptomaine poisoning is at all comparable with the imaginary ills that preservatives are supposed by some people to produce. So common, so important, and so incessantly menacing is this danger that most, if not all, works on the practice of medicine contain references to the subject. Professor Osler says: "Foods of all sorts may become contaminated with the bacteria of putrefaction, the products of which may be highly poisonous." Under the head of "Meat Poisoning" he tells us that "Cases have usually followed the eating of sausages or pork pie or head cheese, and also occasionally beef, veal and mutton. Sausage poisoning, which is known by the name of *botulism* or *allantiasis,* has long been recognized, and there have been numerous outbreaks, particularly in parts of Germany. Similar attacks have been produced by ham, beef and veal. In the majority of these cases the meat has undergone decomposition, though the change may not have been evident to the taste. The symptoms of meat poisoning are those of acute gastro-intestinal irritation." Here the professor quotes a description of the symptoms as given by Balard, part of which we reproduce in order to show the sufferings of these victims. After giving the time it took for the suffering to begin in 102 of the cases, he says: "In many cases the first definite symptoms occurred suddenly, and evidently unexpectedly, but in some cases there were observed during the incubation more or less feeling of languor or ill-health, loss of appetite, nausea, or fugitive, griping pains in the belly. In about a third of the cases the first definite symptom was a sense of chilliness, usually with rigors, or trembling, in one case accompanied with dyspnœa; in a few cases it was giddiness with faintness, sometimes accompanied with a cold sweat and tottering; in others the first symptom was a headache or pain somewhere in the trunk of the body—*e. g.,* in the chest, back, between the shoulders, or in the abdomen, to which part the pain, wherever it might have commenced, subsequently extended. In one case the first symptom noticed was a difficulty in swallowing. In two cases it was intense thirst. But however the attack may have commenced, it was usually not long before pain in the abdomen, diarrhea, and vomiting came on, diarrhea being of more certain occurrence than vomiting. The pain in several cases commenced in the chest or between the shoulders, and extended first to the upper and then to the lower part of the abdomen. It was usually very severe indeed, quickly producing prostration or faintness, with cold sweats." (Practice of Medicine, pp. 392, 393.)

Let the reader picture himself a victim of such symptoms, and then ask his own best judgment whether preservatives in food can possibly be the worse of the two evils. It is but a small fraction of our daily food that ever needs protection by preservatives. It is not necessary to protect but a small part of the perishable articles we consume in this way. Would it not be wise to make the use of preservatives permissible by those who know that perishable foods are about to be exposed to conditions of delay that make their future use dangerous? All food in which there is a certainty of being damaged by decay before it can be canned or put into cold-storage, and all food that is not to be consumed and must be left in conditions that make for decay should be protected against such decay by the use of chemical preservatives. No other food really requires such care. If the housewife cannot be trusted to add preservatives to food she has not the facilities for caring for properly, she ought to be permitted to buy foods that are in a condition to keep, without danger, over the period of at least two meals.

In Chemical Bulletin No. 25, Department of Agriculture, we are told that "Frequent cases have been reported of late years of sickness arising from the use of canned meats. The cause seems mainly to have been improper methods of canning, or the use of meat that was tainted before being canned. Unfortunately we can do nothing in such cases by an inspection of the meat, for it generally appears to be all right." (p. 49.) While nothing can be done after the goods are canned, something could and would be done if canners were permitted, without hindrance or loss of prestige, to put upon the market both goods containing and goods not containing preservatives, leaving the public free to buy which they prefer. In this way the meat would not be permitted to go on to that stage of decay that kills and maims, but cannot be detected by health officers or chemists of the Department of Agriculture. Their opposition to the use of preservatives forbids the kind of care that can practically be applied and that would save many lives and much suffering.

Give American citizens the liberty to go into open market and buy preserved foods, when they are too poor to afford refrigerators and ice, and they will willingly consume food not permitted to develop dangerous germs but that now does so because of present repressive measures. The powerlessness of the food inspector to detect the existing danger is acknowledged by all authorities. Allbutt says: "The severest epidemics of food poisoning have not occurred as the result of meat actually putrefied, that is, of meat that can readily be recognized as putrefied by the smell. In most cases, indeed, meat in such a condition would be rejected as food. Moreover, it is known from experiment that the most toxic products of putrefaction are present in the earlier and not in the later (foul-smelling) stages of the process." (System of Medicine, Vol. III, p. 789.) The reason is here given why the foul-smelling food is not likely to be marketed. People having the sense of smell do not choose to purchase it. This is known to all who handle perishable foods prior to canning. The canner will not purchase or put up food that has reached that extreme stage, but he does often, unwittingly, put up meats that have been overkept. The owners of such meats will never be willing to throw them away or to destroy them as long as the odor and appearance are good. Most of them would be willing to do their best to keep such goods from incipient decay, by using preservatives before such decay has begun, providing they could be assured of a market for the goods after the use of the preservatives. Once taught of the danger that exists in such decay and their humanitarian instincts would constrain them to do that much for the safety of their fellow beings. Every person, however selfish, is willing to bear trifling losses rather than bring suffering on others, but many are not willing to bear great losses for the same reason.

That the danger is not confined to the few kinds of provisions we have already referred to, but covers practically the entire list of food products from the animal kingdom, as well as some from the vegetable, may be seen from the statements of numerous authors. We have room to quote from but a few. Anders says: "Various tainted meats, as mincemeat, 'warmed-over' veal pie, carelessly kept chicken salad, badly preserved and canned meats, partially decayed sausages have caused violent symptoms of poisoning." (Practice of Medicine, p. 1219.) Under the head of "Poisoning by Fish," this author adds that "The use of tainted preserved and canned fish, eels, oysters, mussels, crabs, lobsters, and the like, is more frequently the cause of symptoms of poisoning." In the American Year-Book of Medicine and Surgery, for 1897, p. 66, we are told that "Vaughan and Perkins, in a paper on food infection, refer to 3 cases under their observation. The first, a vigorous man of 34, ate canned salmon, and eight hours later suffered nausea, vomiting, and griping pains. A scarlatinous rash covered the entire surface of the body. The pulse was 140, the temperature 102° F. Thorough lavage of the stomach and large intestine was practiced. . . . In the second instance the father, mother, and two children suffered with vomiting and marked exhaustion, but without fever or diarrhea, after a supper of which dried beef made a part. Anaerobic cultures from the interior of the meat developed a bacillus 2 or 3 times as long as broad, motile, not liquefying gelatin, but coagulating milk. It grew best at the temperature of the body, and developed its poison at the ordinary temperature. It was pathogenic to white rats and guinea-pigs. In the third instance a number of men at a banquet were affected. All those who ate of pressed chicken, and some persons not at the banquet, but who aided in preparing for it and ate small parts of the chicken, became ill. The attacks began 2 to 4 hours later with nausea, violent griping, and purging. Many fainted while attempting to rise from bed. The chickens had been killed Tuesday, and were not used until Thursday. Two micro-organisms, a slender bacillus from four to five times as long as broad, and a streptococcus, were developed. The bacillus was fatal to white rats, guinea-pigs and rabbits; the streptococcus was not fatal, but caused sloughing. Brush reports a case of fatal poisoning by oysters. The patient suffered with vomiting, vertigo, paralysis of the muscles of the throat, the pupil, and of the face, with paralysis of the walls of the bladder and general weakness. . . . Bell records a case of poisoning by canned oysters which occurred in three of a family of four, the fourth not having partaken. . . . Cameron reports an epidemic of vomiting and purging in 74 nuns and girl pupils in a convent at Limerick. The only article to which suspicion could be attached was some custard, and this given to pigs, induced severe diarrhea. The eggs from which the custard was made were stale."

According to the London *Lancet,* "Sausages are extremely liable to undergo decomposition and become poisonous owing to the elaboration of toxic substances during the putrefactive process. . . . The smoked sausage is a much safer article of diet than the unsmoked sausage, since the curing process preserves the meat substances against decomposition by reason of the empyreumatic bodies present in the wood smoke which is used for this purpose." (Editorial, *Lancet,* April 8, 1899, p. 980.) Since the empyreumatic substances here referred to are creosote, carbolic acid, and other chemical bodies, usually deemed poisonous, it appears that this high medical authority believes in choosing the lesser of two evils. If smoked sausages are safer and better than those that are not smoked why are not sausages protected by less toxic and less strong tasting agents better still? Must we forever be tied to the methods of our savage or barbarous ancestors? Why put up a sign before men of science warning them back from practical research and trial of new and more efficient means than any yet at our command? This is what restrictive legislation does. The doors of scientific research should not be closed in such a manner, and our best preservatives now obtainable should be free for use in ways and under conditions that will minimize any supposed or real danger that lurks in their use.

As an illustration of the benefits already obtained by the use of one modern preservative that has extensively taken the place of common salt, the following citation from the report of the British Parliamentary investigation on Food Preservatives is to the point. The representative of the London Chamber of Commerce was asked by the chairman of the investigating committee if he could remember the condition in which meat used to enter England from abroad before they began to use borax and boric acid instead of salt. He replied: "In the old times we used to have tons and tons of taint coming into the country—that is, decomposition had set in—and the losses were colossal. . . . For three or four years we had, steadily, tons and tons of taint, and that it was most difficult to combat and find out what was the cause. That was prior to the use of this preservative. Directly we commenced with it, it was a case of Eureka; we had found it out, and taint is an unknown quantity, practically, now. If there should be any taint it is absolutely due to the neglect of the man in the cellar." (English Blue Book, p. 7, Question 188.) There are those who wish to force us to return to those times of taint by prohibiting the use of all preservatives except those of our ancestors. They are not found among experienced packers, but usually among those having no practical experience in the care of perishable foods. Their opposition is usually founded on theoretic or on sentimental grounds.

It is usually difficult to trace with certainty the original source of contamination of perishable food products with ptomaine or toxin producing germs. In the case of fowl, fish, and meats, handling and exposure during the operations of killing and dressing as well as during transportation, are the chief methods of primary infection. In the case of vegetables and fruits pollution most frequently occurs by the crude methods of adding fertilizers to the soil. The most superficial knowledge of the methods of suburban and so-called kitchen gardeners gives one a speedy realization of the necessity of some method of protecting public health from the very positive danger that here threatens. In 1902 the Paris Committee on Public Hygiene "recommended that on all contracts concerning irrigation by sewage there shall be inserted a clause interdicting the use of sewage in connection with the cultivation of such fruits (strawberries, etc.) and vegetables (salads, etc.) as are destined to be eaten raw." (*American Medicine,* May 17, 1902, p. 382.) The futility of such a law is obvious to practical minds. One has only to consider the kind of people engaged in such employment to perceive how insuperable the difficulties that would be met in teaching them why they should not use sewage or privy manure on these as well as on other vegetables. They believe themselves to be careful, and they are of the opinion that a shower of rain, or a little sprinkling of water, will overcome all the danger they can conceive as possible to occur from their methods. To forbid their using manure of any kind on such products would simply lead to their using it all the more frequently in a surreptitious manner. They know that by using such things their crops are improved and bring them better prices, and no legislation, even if they ever hear of its passage, is going to make them respect its mandates when they deem them unreasonable. This danger must be met in some other manner if it is to be met successfully.

In the American Year-Book of Medicine and Surgery we are told that "the kitchen gardeners of Bayonne are accustomed to sprinkle the foliage of certain leguminous plants with the contents of privy vaults diluted with water, and that the products are eaten raw as salads. Several cases of typhoid fever among the officers of the garrison were traced to this source, and an expert found upon these plants the bacilli of typhoid fever, the coli communis, streptococci, staphylococci, the bacillus tuberculosis, and the joints of tenia." (1898, p. 1004.)

The following quotation from an editorial in *The Journal of the American Medical Association* makes clear the danger which we wish to impress upon our readers as a very positive one, and one that needs thoughtful consideration from sanitarians. The editor says: "Some time ago *The Journal* noticed editorially an epidemic of typhoid in an Eastern institution that was traced to eating raw celery, and incidentally pointed out the possible dangers of eating uncooked garden vegetables. Quite recently a series of observations have been made by Professor Gualdi, of the Bureau of Hygiene, at Rome, on the relations existing between the occurrence of typhoid and the consumption of raw vegetables. As reported in the Rome correspondence of the *Lancet,* he finds a close connection between the two: the seasonal curve of typhoid corresponding very closely to that of the quantity of such vegetables sold in different months of the year. Neither the water supply nor milk contamination are able to satisfactorily explain the facts that can be accounted for in this way. At Padua a careful and extended microscopic and bacteriological study of garden vegetables has also been carried out by Professor Ceresole, which clearly demonstrates their importance as typhoid producers. After first thoroughly washing them with the excellent local aqueduct water, the vegetables—lettuce, endives, radishes, fennel, and celery—to put them in the condition in which they are usually eaten, they were cut up fine with sterilized scissors and placed in a flask of distilled and sterilized water. After a thorough shaking the water was examined microscopically and bacteriologically. The microscopic examination revealed, besides a host of innocuous forms, Ameba coli, Balantidium coli, Isotrica prostoma, and Anguillula stercoralis, together with eggs of tenia, oxyuris, ascaris, trichocephalus, and ankylostoma. The bacteriologic examination revealed such a host of species that identification of every one was impracticable, but among them were found Bacillus coli, septicus, tetani, and a form indistinguishable from B. typhosus. Six animals inoculated with washings, after they had been some minutes heated, all died, five from malignant edema and one from tetanus. Four animals were inoculated with washings not heated, one died with malignant edema, one with tetanus, and the other two had locally, at the point of inoculation, large abscesses from which pure cultures of streptococcus and staphyloccus were obtained." (January 5, 1901.) Let the reader particularly note the fact that it was from *washed vegetables* that these results were obtained. Careful washing cannot remove all of the dangerous germs that have found lodgment in angles and recesses of the salad or fruit. Nothing short of some method of preserving can make them safe.

As most disease germs require an alkaline medium for their development, the treatment of such vegetables and fruit to solutions of acids would often be of service in ridding them of danger. Professor Ceresole reported that he found tartaric acid efficient. The limit to the sterilizing power of tartaric acid is so narrow that it would be advisable, where certainty of results is so desirable, to use an acid possessing a wider range of antiseptic power. Vegetables subject to such exposure are certainly not of a kind to be trifled with by people who are susceptible to the specific diseases whose germs they bear. The fact that multitudes of people are constantly subjected to exposure of this kind, and yet neither take the diseases nor are they attacked with the symptoms of ptomaine poisoning, indicates that it is not in ordinary contamination that the chief danger resides, but in the delays, under favorable conditions, for the multiplication into dangerous amounts of the specific germs. Delays, particularly in warm, damp weather, permit a few germs to become myriads, and raise the number swallowed in any given portion of edible material to a point where the system can no longer cope with them. A few dangerous germs that the protective forces of the body can cope with may be harmless, but more than these become serious. Delays of an unusual character are never foreseen at the time perishable goods are starting, but no sooner have the conditions that make for delay developed than the shipper knows that his goods are in danger. As soon as such delays are perceived to be inevitable, would it not seem to be a judicious proceeding to sprinkle salads, fruits and other vegetables with some potent antiseptic that could be removed by washing when they were to be marketed or canned? Indeed, what great harm could come from sending to the market many kinds of foods that are washed, before being eaten, with a sprinkling upon them of some acid antiseptic capable of destroying the germs that Ceresole tells us he found upon such goods?

If food preservatives have the power of checking germ growth and if germs are responsible for the suffering and death depicted in this chapter, why should not such preservatives be used? To say that preservatives are injurious to health may or may not be a sufficient reason for objecting to their use. If the injury they do is less than the injury done by poisonous toxins, why not choose them in preference to the toxins? The latter are certainly many fold more poisonous than the most dangerous antiseptic that was ever proposed for use as a food preservative. Professor Harvey W. Wiley (Bulletin 13, Dept. of Agr., Div. of Chem., p. 263) has tersely stated the case when he says: "Hundreds of cases are on record of death produced by ptomaines in food which was entirely palatable. Now, in such cases, granting that an antiseptic may have some injurious effect, it is perfectly demonstrable that that injurious effect is far less than that produced by those products of fermentation, and in this instance the public health would be conserved by the addition of an antiseptic." The cases of ptomaine and toxin poisoning herein cited are all very certain evidences of injury from *unpreserved food,* and it would be quite easy to multiply them enormously. They are almost of weekly occurrence. When we add to this the fact that the reported cases are *only the extreme cases,* it is evident that there are probably many fold more cases of minor importance, the account of which never reaches the public ear. To match this direful record of human suffering, torture and death, which no one dares deny, how many cases, *of even the slightest injury,* have ever been proven, on any kind of evidence, as due to the use of preserved foods?

CHAPTER II.

FOOD PRESERVATIVES IN COMMON USE.

To enumerate all the substances that have been put forth for use as food preservatives from time to time during the last quarter of a century would occupy too much space for this volume. We shall content ourselves by referring to the most recent of the new, non-proprietary ones and leaving the reader to find the rest in works having a wider scope than this lays claim to. A large number that are marketed under coined or trade-marked names are combinations, in various proportions, of two or more of the preservatives mentioned herein, so that, though we may not refer to them by title, their descriptions and properties are but modifications of the descriptions and properties of such as we here enumerate.

The qualities that conspire to make a good food preservative exist in so few known substances that only a small number have yet been discovered. They must be (a) tasteless or nearly so, (b) possess little or no odor, (c) be almost colorless, (d) have no tendency to decompose in the body into substances the dose of which is smaller than their own, (e) have no affinity for the tissues of the body that would cause them to accumulate therein, (f) be so harmless to the system that their ordinary therapeutic effects cannot be detected when taken in doses of less than three to five grains, and (g) be able to inhibit the development of micro-organisms and molds in amounts considerably less to the pound of food than their lowest adult medicinal dose. The best preservative, other things being equal, is the one requiring the smallest amount in proportion to its dose to protect food. To those using preservatives the cost is important. In making a choice between any two of nearly common cost, the quantity required for use per pound of goods must be considered. If it requires a grain to the pound of preservative costing ten cents per ounce, and only half a grain of another costing fifteen cents per ounce, the highest-priced article is half as cheap again as the apparently cheap one. The substance that requires the smallest amount in proportion to its dose is the most harmless. The ideal preservative would be a substance with a dosage as great as that of sugar, starch, or albumin, and that possessed a preservative power as potent as that of formaldehyde or salicylic acid. At present nothing is known that possesses such qualities. Plant life produces many substances of an antiseptic nature, but most of them have strong odors and peculiar tastes that render them unfit for use as preservatives. At least three of them are, however, now in active use for this purpose. Modern chemistry is able to supply them by synthesis at rates so low that they are exceedingly inexpensive when we consider their usefulness. Physiological chemistry has already given us a hint that carries the possible one step nearer the ideal. The bacterialysins hold out promises of future possibilities that are decidedly encouraging. Fifty years ago the production in the laboratory of the aromatic preservatives was as much a dream as is that of the future production of lysins or kindred bodies. But, if science is to be stimulated toward progress in this direction, the temptation of promised wealth must not be removed from the way of the experimenter. Hope of remuneration may not be the only stimulus toward such work, but it is a strong one. By permitting free competition in the use of preservatives, newer and better ones are sure to be sought for and discovered. By narrowing the sphere of preservatives or by forbidding their use, the stimulation toward the making of new discoveries is cut off. "But," some reader may say or think, "when preservatives have been found that are as harmless as starch or albumin, all opposition to their use will cease." It is quite doubtful whether even then conservatism will surrender, but, even if we might hope that it would, it will be well to remind such readers as have thought this thought of the case of the simpleton, mentioned in Xenophon's "Anabasis," who, on trying to swim, was nearly drowned in the attempt, and who then swore never again to go near water until he had first learned to swim.

The oldest known preservatives are salt, smoke, alcohol, vinegar, and resinous substances. At a later date came the use of sulphur fumes and saltpetre. Salt is probably the oldest known food preservative. Accidental preservation of food in salt lakes or salt marshes may have given the suggestion by supplying something to eat when more palatable food was unavailable. The liking for it would naturally grow under use. Smoke, too, probably came as an accidental discovery. Meat hung up to dry in the smoke saturated tents and huts of savages, being found to keep better than that dried in the open air, and particularly during damp weather or in damp climates, came to be used extensively because of this advantage. Habit would soon fix a liking for the smoky taste and immunity from injury from its use. The knowledge of the protective qualities of alcohol and of vinegar must have succeeded the use of these as beverages and as condiments. The liking being established by the eating of fermented and soured fruits and the drinking of their expressed juices after fermenting and souring, it was a simple step to the discovering of the preserving qualities of the strongest samples. Resinous substances were adopted for embalming purposes, and must have been found equally efficient for protecting meat. The fumes of burning sulphur were used for disinfecting purposes by the ancient Greeks, and were later employed for the cleansing of wine-casks and for imparting keeping qualities to wines and ciders. The resinous constituent of hops, together with the small amount of contained alcohol and the carbon dioxid given off during fermentation, constituted the protective elements of beer, but sometimes sulphur fumes were resorted to for further protection prior to the introduction of more modern preservatives. Saltpetre was used at quite an early date to impart a more natural color to beef "corned" in salt brine. In the olden times, when these various preservatives first came into use, they knew nothing of the more modern concentrated forms of the preservative principles they contained. The user of salt has always had this article in a pretty concentrated form. It would seem, however, from the Scriptural reference to salt that had lost its savor, that the ancient article was not of the purest in quality. It was a very long time before it was discovered that the preservative power of smoke was lodged in substances as poisonous as carbolic acid and guaiacol. It was almost as long a time between the first use of a wine or a vinegar as a preservative to the purifying of these down to their active constituents of absolute alcohol and glacial acetic acid. Ancient as is the preservation of the dead by embalming, it was not till modern times that it was discovered that the content of the balsams to which the embalming power was due was no other than our well-known food preservative—benzoic acid. As the use of the crude balsams has given way to the use of their more concentrated representative, benzoic acid, so the use of smoke is being superseded by a more concentrated representative, that can be applied more quickly and more economically, and that is sold under the names of liquid smoke and pyroligneous acid. Sulphur fumes, though still used for sterilizing casks, have given way in other directions to sodium sulphite, its solid chemical representative. This latter salt has likewise, in great measure, taken the place of saltpetre in imparting a nearly natural color to meat that has darkened by its loss of oxygen.

CRUDE PYROLIGNEOUS ACID.

This liquid is used for preserving hams, herrings, sardines, and so-called "smoked" provisions of various kinds. It imparts to salted meat or fish the flavor of smoked goods of the same kind, and enables them to resist decay in a similar manner. The cheapness of the material and the ease with which such treatment can be applied gives it an advantage over the old way of smoking provisions. It is not a true acid, but a crude sort of wood vinegar, and is composed of water, acetic acid, wood alcohol, creosote, empyreumatic oils, tarry substances, and, perhaps, some traces of formaldehyde. It is of a dark-brown color, has a strong, smoky odor, and is prepared by the destructive distillation of wood. It contains from one to one and a half per cent. of creosote, and, as immersing meat or fish in solutions of beech-wood creosote of one per cent. imparts about the same protective power, it is assumed that the contained creosote is what confers upon it the power to preserve. The opponents of modern preservatives would probably oppose this innovation, if they could be quite sure that they could always tell it from the food protected by the old-fashioned method of smoking.

SULPHUROUS ACID AND SULPHITES.

Sulphurous acid (H_2SO_3) and its anhydrous form of sulphur dioxid (SO_2) find their chief use in sterilizing barrels and casks in which weak wines, ciders, and fruit juices generally are to be stored. In this way, as sulphurous acid, they become blended with the liquids and serve as aids to their preservation from decomposition. This acid is largely used in the manufacture of glucose, syrups, and sugar, so that, though not intended for preservative purposes in such cases, it represents the same to the public as if used as a preservative. It is part of their daily food. Food commissioners and food chemists, for some reason, do not interfere with sugar manufacturers and candy men as they do with catsup bottlers and fruit-juice bottlers. Various kinds of dyes of the brightest hues and preservative substances in proportions far greater than the latter are in the habit of using are passed as all a matter of course and unworthy of note when present in candy. Sugar can be loaded with blueing and syrup with sulphurous acid, candy can contain salicylate of methyl and oil of bitter almonds, without a word of protest; but woe to the man who deals out the one-hundredth of a grain of a harmless preservative in articles of food that are pretty certain to bring sickness when not present. The candy is only eaten by children, and the commissioners may think that they do not count. Benzaldehyde, prussic acid, and sulphurous acid might hurt adults, in however small a dose, but they evidently think that these things cannot hurt children, if we can judge from the way they deal with this problem.

The neutral sodium salt of sulphurous acid (Na_2SO_3), the acid sodium salt of the same ($NaHSO_3$), and the calcium and magnesium salts, have all been used as food preservatives at various times. Neutral sodium sulphite is the one now most commonly used. It is found in commerce as a white amorphous powder, or in the form of transparent, colorless crystals containing seven molecules of water. This makes it contain about fifty per cent. of its weight as water of crystallization. Its chief use is more as a color-carrier to meat than as a preservative. Its slow alteration into sulphite of sodium gives it the double power of acting as a color producer and as a preservative, but its preserving powers are rather weak. Immediately after an animal is slaughtered its flesh is of a bright-red color, owing to the presence in it of oxy-hemoglobin. Very quickly the hemoglobin gives up its oxygen and takes on the carbon dioxid of the air, thus making the same kind of change as occurs in blood when it changes from arterial blood to venous blood. The meat turns of a bluish color, though quite fresh and in no sense decomposed. To prevent this darkening of meat, saltpetre has been used. It gives up NO to the hemoglobin, forming NO-hemoglobin, that is more like arterial blood. Sodium sulphite gives up, in the same way, SO to the hemoglobin, and thus forms SO-hemoglobin, that is even more like oxy-hemoglobin than is NO-hemoglobin. No such chemical change could occur if the hemoglobin had changed its chemical composition by decay. The brighter the red produced, the stronger is the evidence that the meat is fresh. Meat not treated in this way gives no evidence regarding its deterioration until so bad that the odor tells. Chopped meat, Hamburg steak, etc., of the most inferior character, could be palmed off upon the public, if only the dark kinds were permitted to be sold. In order to retain the color, less than one grain to the pound of meat is needed, and, as this is sprinkled upon the surface, fastidious people can easily wash it off before cooking. The dose of sodium sulphite is from thirty to sixty grains, but larger doses can be given with safety. Its presence on meat can be determined by washing in water, evaporating the washings to dryness, and then adding a little dilute hydrochloric acid. Fumes of sulphur dioxid will be given off, and these can be detected by the odor. For volumetric determination of the quantity on meat the washings from a definite amount are decomposed by the addition of dilute sulphuric acid, distilled into a flask under proper precautions to avoid loss, and then titrating the distillate with volumetric solution of decinormal iodine and using starch as indicator.

SALICYLIC ACID AND SALICYLATES.

Salicylic acid is used as a preservative of weak wines, bottled beer, cider, unfermented fruit juices, fresh fruit, and for use in pulped fruits that are being transported from the countries of their growth to places where packers and canners manufacture them into jams, jellies, marmalades, and the like, for the protection of bottled summer beverages of a non-alcoholic character, for the saving from decomposition of catsups, sauces, chutneys, and other relishes, during the prolonged period between the opening of the bottles and their slow consumption and for other purposes of a similar character. The sodium salt ($NaC_7H_5O_3$) is used for the same purposes as the acid, but chiefly in fruits and fruit preparaions, beverages, etc., that are of acid reaction. Salicylic acid ($HC_7H_6O_3$) exists in light, fine, white crystals of minute size. It is but slightly soluble in water, but dissolves pretty readily in alcohol. Sodium salicylate is a white, odorless powder of a sweetish, peculiar taste. It is readily soluble in water. Salicylic acid is used as a preservative in quantities of about one grain to the pound or pint of the food or beverage. Sodium salicylate requires about one-third more. The doses of these substances range from fifteen grains to considerably over sixty grains. The presence of salicylates is determined by first extracting from the food and then testing the extract. The food containing the acid or its salt is macerated in water made slightly alkaline with sodium hydrate and strained or filtered. To the filtrate is added dilute sulphuric acid in slight excess beyond neutralization. This is next shaken with ether or chloroform, and the solution in the solvent used evaporated on a porcelain vessel. If oil or fat is present, the ether solution should not be evaporated, but should be shaken up with dilute ammonia, and the ammonia solution of the acid separated from the ether or chloroform. By evaporating the ammonia solution on a water bath and testing with ferric chlorid a bright violet color s evidence of the presence of salicylic acid or a salicylate. If no oil or fat are present, the application of the ferric chlorid to the contents of the porcelain vessels after the evaporation of the ether or chloroform will determine by the same color the presence of salicylic acid.

BORIC ACID AND BORATES.

Boric acid is used in the preservation of hams and bacon, fresh meat that has to be transported out of the regions reached by cold-storage, fresh oysters and shellfish that are carried from the seaboard, dried meats that have to be exposed in damp climates, dried fruit having similar exposure, and fresh butter subject to distant shipment. It has likewise been used in milk, but the quantity required is so near medicinal doses that few are willing to recommend it for this purpose. As it is applied on the outside of fish and meats, it can be washed off from these and the dose reduced. Borax, or sodium diborate ($Na_2B_4O_7$), is less efficient than boric acid but more soluble in water. It is sold as a white powder and n large, transparent, colorless crystals, having an alkaline taste. Boric or boracic acid (H_3BO_3) is in fine, white, minute, crystalline scales that are almost tasteless in dilute solutions and are perfectly odorless. Its acidity is very slight. Its preservative powers are so low that its chief use and its safest use is on foods from which it can be removed by washing and on which it is applied as a surface protection. One grain of benzoic, or of salicylic, acid has more preservative power than five or ten grains of boric acid; but, owing to the tastelessness, lack of odor, and other characteristics, as well as cheapness, it has met the requirements of commerce in some directions better than either of the others. The dose of boric acid, as fixed by all the principal works in therapeutics, is less than that of benzoic or salicylic acids. This indicates that the medical profession has been forced, by its experience extending over many years, to deem its effects, grain for grain, as more serious on the human body than the effects of the organic acids named. While all three of these can be used with perfect safety for the purposes in which they are usually employed, it is well for those who look upon boric acid and borax as safe while salicylic acid and salicylates with benzoic acid and benzoates are deemed unsafe, to know these facts. So much more safe, in the doses required, are the benzoates and salicylates that there is but small room for inquiry or doubt. How any person could examine the facts and doubt the conclusion is a mystery. This fact, however, cannot harm boric acid, for, as intelligence grows and conservative bias diminishes, it will come, in time, to be established as a necessity of civilization. The usual dose of boric acid is ten to thirty grains. It can be taken in doses still larger without harm. The presence of boric acid and borates in food products is determined by evaporating to dryness on a water-bath after making alkaline with lime water. The organic matter is next burnt from the residue, and the latter rendered slightly acid with dilute hydrochloric acid. Next add a small amount of concentrated hydrochloric acid and moisten a piece of turmeric paper with the solution. The paper on drying will assume a characteristic red color if boracic acid or borax was present. Ammonia changes this red to a blue-green, and an acid will turn it red again.

BENZOIC ACID AND BENZOATES.

Benzoic acid ($HC_7H_5O_2$) is used as a preservative of fruit juices, catsups and other relishes, wines, ciders, etc. It is a natural constituent of various kinds of fruit seeds and of gums and balsams of various kinds. In fruit seeds it is a product of the oxidation of benzaldehyde. This latter substance is well known to most people by the peculiar taste which it imparts to the seeds of plums, cherries, peaches, apricots, and bitter almonds. The peculiar flavor of oil of bitter almond is due to it and its close chemical relative, prussic acid. Union of this benzaldehyde with the oxygen of the air produces benzoic acid. Mere contact of air with it seems to cause a slow production. For a long time its chief source was gum benzoin, then it was in large part obtained from the decomposition of the hippuric acid of the urine of herbivorous animals, but now its chief source is from the toluine of coal tar. The chief form in which benzoic acid is used as a food preservative is as sodium benzoate ($NaC_7H_5O_2$). Benzoic acid is a white or yellowish-white, crystalline powder, or it is marketed in the form of small, needle-like masses of soft crystals. It possesses a warm, acid, somewhat unpleasant taste, a slightly aromatic odor, or is sometimes odorless, volatilizes slightly on exposure to warm air, and darkens in color by exposure to light. It is only to a small extent soluble in water, but will dissolve in two parts of alcohol. Its solubility in water is increased by the addition of a little borax. Sodium benzoate is a white, amorphous powder with a sweetish, astringent taste. It is soluble in a little less than two parts of water and in forty-five parts of alcohol. It is used in the proportion of from one grain to one and a half grains to each pound or pint of food or beverage that is to be preserved from decomposition. The doses usually administered by medical men are from ten to thirty grains several times a day. The determination of the presence of benzoic acid in a food product is made by first getting a solution in water, treating with sulphuric acid to decompose the benzoate, washing out of the solution the benzoic acid with ether, separating the etherial solution, and evaporating. The addition of a few drops of ferric-chlorid to the residue before drying will give a characteristic flesh-colored precipitate. A still better test of the residue can be made by adding to it 0.5 Cc. of a 0.02 per cent. solution of rosanilin hydrochloride in analin oil and heating on a sand-bath to boiling. The red solution will change to violet-blue, and the more benzoic acid present the more pronounced will be the blue. It can be had as a pure blue by adding a slight excess of hydrochloric acid, diluting with water, collecting the precipitate on a filter, washing with water, and dissolving in alcohol.

FORMALDEHYDE.

Formaldehyde (CH_2O) is a colorless gas obtained by oxidizing wood alcohol. It is also known as oxymethylene, formic aldehyde, formol, and formalin. It has been used as a preservative of milk and of meat. It is sold as a solution in water, usually containing about forty per cent. By keeping on hand long and by not protecting by perfect corking, the solutions sold are often much less than forty per cent. strength. It cannot be made of any greater concentration than forty per cent. without polymerizing and precipitating as para-formaldehyde ($C_3H_6O_3$), a substance with but slight antiseptic power. The solutions usually contain some formic acid, and the vapors severely irritate the eyes and mucous membrane of the nasal passages. It is a powerful antiseptic, and is said to prevent milk from decomposing in proportions of one to two or three thousand. It prevents yeast from fermenting in one to twenty-five hundred. It has been found that it hardens the casein of milk so that it becomes less digestible, but in ordinary amounts does not hinder peptic digestion by any special effect on the enzyme. Its peculiar irritating quality on mucous membranes and on wounds has kept it from being used much in either medicine or surgery. Its dose is therefore a matter of some doubt. The fact that an ounce of a solution containing less than forty per cent. produced serious symptoms that caused the life of the victim to be despaired of would indicate a maximum dose of less than a dram of the absolute gas. This would reduce the mean dose to less than fifteen to twenty grains, or less than a teaspoonful of a solution of the usual strength. Of course, if taken at all, it would have to be highly diluted. One of the simplest methods of detecting formaldehyde is to heat a small quantity of the milk to nearly boiling after adding to it an equal volume of strong hydrochloric acid containing one part in five hundred of ten per cent. ferric-chlorid. A violet color indicates formaldehyde. Another method is to strongly acidify with phosphoric acid the milk that is to be tested, and then distil off about one-fourth of its volume. To a quarter of a teaspoonful of distillate add two drops of sulphuric acid and two drops of a solution of one part of phenylhydrazin hydrochlorid and one and a half parts of sodium acetate in ten parts of water. The production of a green color tells of the presence of formaldehyde.

NAPHTOL.

Late reports from States where the best known preservatives have been interdicted have been showing that beta-naphtol ($C_{10}H_7OH$) has come into use as a food preservative. It and hydro-naphtol ($C_{10}H_{12}O$) have both been said to be used in milk. Every attempt at suppressing one kind of preservative has always ended in the introducing of some other, and the new ones are not always quite as safe as the older ones. The real wants of a community can no more be suppressed than Vesuvius could be corked up. The attempt at the former may lead to conditions about as disastrous as would any attempt at the latter. Beta-naphtol is prepared from naphthalin, the well-known substance that has taken the place of camphor for preserving clothes from moths. It is generally sold as moth-balls. Beta-naphtol reaches the market in the form of colorless, shining flakes, or as a white to yellowish-white powder with a faint odor and a sharp taste. It is very insoluble in water, but quite soluble in alcohol. Hydro-naphtol occurs in shining white scales that are likewise quite soluble in alcohol and but slightly soluble in water. The latter is a condensation product of the former. At one time they were declared to be but two names for the same thing. They are both active germicides and antiseptics. Their rôle as food preservatives is quite new, but, judging from their properties, they would be expected to act in amounts of a grain or less to the pint or pound. As their doses range from two to ten grains, they are less safe, as preservatives, than benzoic or salicylic acids. Indeed, they more nearly resemble carbolic acid. The addition of ferric chloride to a solution containing naphtol will give a greenish color, and after standing white flakes will precipitate that, on exposure to heat, turn brown. It can be volumetrically estimated by adding standard iodine to it in warm aqueous caustic sodium.

HYDROGEN PEROXID.

The preservation of milk by the use of hydrogen dioxid, or, as it is also called, hydrogen peroxid (H_2O_2), has recently been advocated by the *Bulletin Medical.* In quite a number of instances in the past its use for this purpose has been suspected, and in some it has been detected. The *Bulletin* advocates using from one to two per cent. of a twelve volume solution, and claims that when this amount is added to milk it will keep perfectly sweet for three or four days. The peroxid destroys most of the germs that invade milk, but is said to have no effect upon tubercle bacilli. It therefore cannot protect the users of such milk from acquiring tuberculosis if the milk has come from cows suffering from this disease. The fact that hydrogen dioxid stops the development of the germs of lactic acid and permits the tubercle germs to live does not argue very favorably for its use. The lactic acid germs are the natural enemy of many disease-breeding germs. The hopes entertained for hydrogen dioxid when first introduced as an antiseptic have not been borne out from its practical use. As a food preservative its easy destruction by oxidizable substances soon renders it inert, and the preservative power, even where the substance is unimpaired by chemical change, is subject to inhibition by the presence of ammonia and some alkaloidal bases like nicotine and aconitine, as well as by such organic acids as prussic acid. It is possible that the ptomaines, since they are alkaloids, may have a similar retarding effect. Another drawback to the use of hydrogen dioxid as a food preservative is the uncertainty of the strength of the solutions. One that is official to-day may not be to-morrow, and few users would know how to gauge the required amount. This, by creating failure and confusion, must lead to its final abandonment as unpractical until such times as simple assay methods are devised that anybody can use. The acids used to give it its present keeping qualities are not always the same in kind or amount. These would come in for condemnation as adulterants. The official hydrogen dioxid of the drug store is a solution in water of three per cent. of the gas. It is capable of giving off from nine to eleven volumes of oxygen on being decomposed. The solution is without odor or color, but has a sour taste due to the added acid that is supposed to keep it from decomposing. When taken into the mouth, and when added to organic substances, it foams like soap suds. When taken into the stomach in appreciable amounts this foaming creates a sense of distention that is uncomfortable. No dose has ever been fixed since the harm it does is due chiefly to the distention and pressure it produces in the stomach. By decomposing into water and oxygen its products are, chemically, quite harmless.

The recent production of such bodies as diacetyl peroxid ($C_4H_6O_4$) and benzoyl-acetyl-peroxid ($C_9H_8C_4$) have shown what organic chemistry is likely to do for us in the production of bodies with high preservative power. The solution of these bodies in water and their transformation into peracids supplies solutions of intense antiseptic potency. It will be some time before they can be produced at prices that will make them available as preservatives. The fact that they have been produced is hopeful.

The presence of hydrogen dioxid in a solution can be determined by adding to some of it in a test tube a small amount of a solution of potassium dichromate, a little dilute sulphuric acid and some sulphuric ether. The ether layer, on allowing it to rise to the surface, gives a purple color, the intensity of which is in proportion to the amount of the dioxid present.

BASIC ALUMINUM ACETATE.

There is no evidence that this preservative has been used on foods by Americans. Samples of imported sausages from two different foreign manufacturers have been found to contain it. (Jour. Amer. Chem. Soc., June, 1904, p. 662.) The bitter prejudice that has been instilled in the public mind against aluminum preparations will probably hinder its becoming popular here, whatever might be its merits. The fact that it has not been used in medicine to any extent makes it impossible to fix with any degree of definiteness its dosage. It may be very dangerous or it may be relatively harmless so far as experimental evidence has gone. The probabilities are that it is undesirable. The dose of aluminum-ammonium sulphate and aluminum-potassium sulphate being as low as ten to twenty grains would tend, by inference, to put the dose of the acetate still lower. Its astringent and emetic qualities, together with the uncertainty of its exact chemical composition in any given sample, would seem to be sufficient reason for considering it undesirable as a food preservative. Its preservative powers are low, its dose must be low and very uncertain as to amount, the uses to which it is generally put do not prepossess us in its favor, and if left to fight its way into an untrammeled field there would be little doubt of its condemnation by users of preservatives. True aluminum acetate ($Al_2(C_2H_3O_2)_6$) has never been isolated. The so-called acetate is so deliquescent that it only exists in liquid form. It is found in commerce under the names of "red liquor," and "mordant rouge." It is not red, but colorless, and gets its name from the fact that it is the principal mordant used by calico printers for fixing their red colors. It is also employed in the preparation of waterproof woolen fabrics. The detection of this and other aluminum salts in food is made by burning to ash on a platinum vessel, extracting with boiling water, filtering and then adding to the filtrate a few drops of ammonium chloride. A flocculent precipitate is evidence of its presence. Confirmation can be had by filtering off the precipitate and testing it on charcoal with cobalt nitrate.

CHAPTER III.

ARE FOOD PRESERVATIVES HARMFUL?

PRACTICAL men, interested in knowing exactly what the effects of any given food preservative might be upon users of preserved foods, have tried such preservatives upon themselves, upon their friends, and upon animals. After thus putting the matter to the test of experiment, they have drawn their conclusions from what nature has had to say about the matter. The dictum of no human authority, unbacked by experimental evidence, is of the slightest value where experiment clearly shows that such authority is wrong. We have an example of the true scientific and practical spirit in the reply of Professor Attfield, editor of the *British Pharmacopœia,* to a question propounded to him by the Parliamentary Committee on Food Preservatives. When asked if, because an article acted as a good food preservative, he thought it necessarily followed that it should injure digestion, he replied: "That seems to be a most reasonable inference, but it does not accord with my experience; it is not true in my judgment." (British Parliamentary Blue Book, p. 225.) He placed experience above inferences drawn from old scientific beliefs. An old theory of his school days, which we will consider later in this volume, was placed in opposition to his experience, and while he acknowledged that the inference based on that theory seemed to him to be a sound one, he could not believe it to be true because it did not accord with his experience. To most men of advanced life the early school-day teachings would have appealed with greater strength than even their own experience. Only the scientific habit he had later acquired saved him from joining with others of his age in condemning preservatives without a proper hearing. During the same examination of this Parliamentary Committee the following question was propounded to another gentleman:

"Could you tell the committee whether that prohibition was arrived at as the *result of experiment* or *only* upon what we may perhaps call *the evidence of expectation?*" (Ibid, p. 177.) The committee had found the "evidence of expectation" so common an element in the opposition to food preservatives that it became necessary for them to be on their guard by thus pointedly asking which kind of evidence the witness was giving. In these two illustrations we see the difference in the methods of the two classes of reasoners who have taken up the consideration of this subject. The one seeks to make a substantial appeal to nature and the other stands upon theories which he is waiting, hoping and expecting will yet be verified. On this "evidence of expectation" there is no hesitancy in forcibly condemning such preservatives as, according to their theories, must be bad. The question put to Professor Attfield, as answered above, is the keystone of the entire theoretic structure on which past opposition was built. According to this, the better the preservative might happen to be, in its preserving power, the more dangerous it was assumed to be to the digestive organs. In our next chapter we will discuss this old notion and show how unsubstantial the grounds were upon which it was built. In the meantime we find that this very theory has so directed the growth of evidence as to practically compel us, at this juncture, to depart from our scheme of treating our subject in a general way and to take up the consideration, for the time being, of a single preservative. Almost the entire force of the opponents of preservatives has been arrayed against this one. For many years it was the first one that analysts sought when they suspected food or drink as containing a preservative. In a paper on "Food in Its Relations to Health and Longevity," published as one of a course on "The Art of Living a Hundred Years" of "The Chicago Record's Current Topics Club," Professor H. W. Wiley said: "The process of digestion is really a process of fermentation, and the presence of these preservatives in food arrests or retards the digestive processes. Some of the most commonly used preservatives have the most active influence in the retardation of digestive activity. Among these may be mentioned salicylic acid, which on account of its cheapness and activity may be called the universal preservative." (*Chicago Record*, Feb. 28, 1901.) Because salicylic acid is highly active as a preservative and because its activity is the result of its antifermentative power, it was here assumed that it had the most active injurious influence on digestive power. This charging of harmfulness on preservatives as inherent in their ability as preservatives led, in the past, to incessant raids upon salicylic acid. To meet the arguments made during these raids is to meet all the chief objections that have ever been urged against preservatives as a whole. The defence of salicylic acid thus becomes the defence of the principle of preserving foods by the use of antiseptics. As it has been held that the evil influence of all preservatives is nearly in direct ratio to their power as preservatives, the upsetting of this doctrine by an array of facts connected with salicylic acid is the same as if the facts had been connected with benzoic or boric acids. The evidence selected is chiefly experimental, so that either the authorities cited told what was not true or their experiences prove, beyond peradventure, that the preservative tried cannot be as injurious as its detractors try to make us believe.

Much has been said of the evil influence upon the human body that the taking of a fraction of a grain per day, of salicylic acid, would produce. Even if the amount was as high as one or two grains per day, how improbable become the chances of harm, in view of the following recorded experiments? Professor Kolbe, of Leipzig, took fifteen grains per day of salicylic acid (one gram), in a pint of liquid, *for nine months.* (United States Dispensatory, 17th ed., p. 87.) At the end of his experiment he wrote: "My health is excellent, and I feel better and stronger than ever." (Wagner's Jahresbericht fur Chemische Technologie, 1877, p. 451.) Surely there is no uncertain sound in a statement like this. If fifteen grains per day for nine months did him no harm, one-tenth of a grain to two grains per day is not likely to injure any adult.

Professor Germain See declares that for a long time two of his pupils took daily, in divided doses, from seventy-five to ninety grains (five to six grams) of salicylic acid, without experiencing the slightest modification of either temperature or pulse. (Medicin. Studien uber Salicylsaure und Salicylate; Leipzig, 1878, p. 16.) The largest quantity of salicylic acid that is likely to be taken in any article of preserved food or drink would probably be found in wine or beer. In the hearings on Pure Food Legislation before the Committee on Interstate and Foreign Commerce, held at Washington in March, 1902, Mr. Wyatt, an authority on such subjects, said that salicylic acid is used when beer is shipped, as it sometimes is from one end of the continent to the other, and may be exposed to sudden and severe changes of temperature. In such cases it has been customary, and he has advised brewers to use salicylic acid, which he regards as the least harmful of antiseptics. The amount used would be about one part in five thousand, or a little less than half an ounce per barrel of thirty-one and one-half gallons. That is about one-quarter grain of salicylic acid per glass of beer (p. 409). Should any person attempt to drink sufficient of this beer to get as much salicylic acid as Professor See gave his students they would find it necessary to swallow over five gallons per day over a long period of time. If every perishable article of a man's diet were salicylated and contained no more than enough to save it from decomposition under ordinary conditions he would not ingest one-tenth the amount per day that Professor See's students took.

Dr. K. B. Lehmann, Lecturer and Adjunct Professor at the Hygienic Institute at Munich, reported in the Archiv fur Hygiene, of 1886, experiments which he conducted with two workmen that he induced to take salicylated beer every work-day for three months. During the ninety-one days of the experiment one of them took 562 grains (37.5 grams) and the other 682 grains (45.5 grams) of salicylic acid. The beer, instead of being treated only to enough acid to protect it, had sufficient to make the taste unpleasant. More could not have been added to the limited amount of beer drunk without creating distinct disgust. Excluding Sundays and holidays, nearly nine grains per day were taken by one of them and about eight grains by the other. Both individuals enjoyed the best of health during the whole period, and the professor declared that, "From these results, I think I may conclude that one-half grain (7½ grams) of salicylic acid, taken every day in plenty of liquid, *is harmless, even if continued for months.*"

As far back as 1855, and before salicylic acid had come into commercial use, as a food preservative, Bertagnini tested it upon himself so as to determine its physiological effects. He declared that as a result of his experiment he was satisfied that no particular effect could be produced when from thirty to forty-five grains per day, in divided doses, were taken. (Denkschrift betreffend die Verwondung der Salicylsaure; Nurnberg; pp. 22, et seq.)

Professor John Attfield told the Committee on Preservatives of the British Parliament, "I have taken it (salicylic acid) and I know it is consumed in large quantities. So far as my experience goes, which has simply been experimental, salicylic acid may be taken in quantities of from five to fifteen grains at a time *without retarding the digestive processes.*" (Parliamentary Blue Book, p. 226.)

Doctors Macalister and Bradley, in the London *Lancet,* said: "One of us took a dose of five grains of the pure acid every day for a month without any ill-health ensuing and a smaller quantity given to children every day with their dinners (in food stuff known to contain it) certainly did them no harm. They remained as bright and active as ever and underwent no wasting." (March 14, 1903.)

In a paper read at the Congress of German Naturalists and Physicians, Nuremberg, September, 1893, Professor Penzoldt stated that he had investigated the question as to what the effects are on digestion of various substances. He had experimentally proven that salicylic acid, in ordinary doses, had not the slightest retarding influence on digestion, even when administered for long periods of time. This phase of the subject will be considered at length in another chapter.

Professor Von Fehling, the German Court-Councillor, once said: "I do not know of a single case in all Germany, where injurious effects have been called forth by the use of foodstuffs or beverages treated with salicylic acid. I have for several years frequently used food preserved with this acid, without feeling the slightest sensation; I know that many people, and even entire families, continuously use salicylated beer, wine and water, and that they have followed this régime for a number of years." (Rev. univ. de la Brass., No. 466, Oct., 1882.)

Professor Blas, of Louvain, after experimenting with and observing the effects of salicylic acid on children, on himself, and on other adults, declares that he could discover no injurious effects from its continued use. (Bullet. de l'Acaden. rouale de med. d. Belg., Vol. 12, No. 9.) Dr. Rochefontaine, director of the National Physiological Laboratory in Paris, put forth a similar claim after the same character of experiments. (Jour. d'Hygiene, Vol. vi., p. 509.)

During the British Parliamentary Committee's investigations of the effects of the use of preservatives, Dr. Thomas Bond, Consulting Surgeon to Westminster Hospital, F. R. C. S., when questioned regarding the use of salicylic acid, stated that he had often given it in ten grain doses. He said: "I have never seen the slightest ill result from taking it." When asked if two grains in a pound of jam would do any harm he replied: "I am certain that it is harmless; I think that the pound of jam (if taken at once) would do more harm than the salicylic acid." Later on he said: "I am quite ready to take ten grains of salicylic acid three times a day for a month. I did once for sciatica." (British Parliamentary Blue Book, p. 107).

Turning from experiments upon human beings to experiments upon animals, we will refer to but one set out of multitudes that have been tried. In September, 1902, the Maryland Agricultural Experiment Station published, in Bulletin 86, the results of experiments extending over two years, in which calves were fed upon milk containing preservatives. The authors of the Bulletin, after telling the amounts put into the milk for the use of the calves, say: "All of these proportions are in excess of the quantities usually supposed to be sufficient in dairy practice." The tables of results show that the calves invariably ***gained in weight*** while under treatment with all the preservatives under trial, except one. They also show that the gain in weight was more when taking salicylated and formaldehyded milk than when taking pure milk. They further show that the amount of milk digested was slightly less when preservatives were used than when pure milk was used. The authors seemed to think that this was against the use of preservatives. The fact that *pari passu* with slight loss of nutrient value came great gain in assimilative value, as shown by increase in weight, would seem to prove that calves, like human beings, eat too much. To lessen the digestive value of the excess seems to increase the assimilative value of the residue.

Turning next to the evidence elicited in courts of justice where cases have been brought against merchants for selling goods containing preservatives, we discover that on all occasions condemnation was based either on theory or the unsupported opinions of gentlemen who were unable to cast off the old notions of a generation ago, while support came from the recitals of experiments or personal experience. Take, for instance, the following from the London *Chemist and Druggist:* "At Southwark Police Court (England) on February 10, Mr. Cecil Chapman delivered a considerable judgment in the case of the Southwark Borough Council *versus* George Mence Smith, which was a summons for selling lime-juice cordial containing eight grains of salicylic acid per pint. The magistrate said he had come to the conclusion that the prosecution had failed. It was a question of fact, and the onus of proof was upon the prosecutors. The evidence on which they relied, however, was almost entirely theoretical, and was based very largely upon the vague words of the analyst's certificate and the recommendations of the departmental Committee upon Preservatives in Foods. Neither of these grounds was at all conclusive or even satisfactory to him for forming a judgment on such a question. Neither of the witnesses for the prosecution had made a special study of the effect of salicylic acid, while for the defense six gentlemen had been called who were experts on the subject. He had no evidence of the sort of persons who habitually used the cordial, except that they were generally teetotallers and children, and he was prepared to accept the statement of Dr. John Thresh that 'the general experience is that salicylic acid in food has been used by hundreds and thousands of persons day by day, and no one has ever reported an authenticated case of any sign of danger from it.' The summons was dismissed, but without costs." (February 14, 1903.) Some years ago the South Bucks *Free Press* gave the following interesting report of a case of the same kind, and, although culled from a local newspaper, as it brings out the peculiar type of argument used by English experts on the preservative question, we take the liberty of quoting it: An important case under the (British) Food and Drugs Act came before the Great Marlow Court, in Petty Sessions, on June 23, 1892; R. Hay-Murray, Esq., and E. Clark, Esq., being on the bench. Matthew John Clifton, of High street, Marlow, grocer and licensed for the sale of British wines, was summoned, on the information of William Sargent, of High Wycombe, Superintendent of Police, for unlawfully selling, to the prejudice of the purchaser, a certain article of food, to-wit, raspberry wine, which was allegedly adulterated with salicylic acid. Mr. Rose-Innes, addressing the Bench, said the Act of Parliament under which those proceedings were taken, was never intended to be used as an engine for the ruinous injury of honest and industrious tradesmen. There was nothing to show that the acid was used for any fraudulent purpose whatever. It was much more costly than the wine itself, and was *simply used to prevent deterioration* of the article. If every person was to be prosecuted for selling an article containing ingredients foreign to itself, yet absolutely necessary for its manufacture or preservation, and at the same time perfectly harmless to the purchaser, then the whole commerce of the country would be paralyzed, and benches of magistrates would be perpetually engaged in the trial of such cases.

The first witness called for the defense was Mr. Granville Sharpe: "I am an analytical and consulting chemist. I found salicylic acid two-tenths per cent., or two grains to a bottle. The acid is very largely used as an antiseptic. I have analyzed raspberry wine before, some made by other makers, and found it to contain salicylic acid, and consider the acid necessary for keeping purposes, not for the manufacture of such wine." Professor W. Lascelles-Scott, examined by Mr. Rose-Innes, said he was a consulting analyst and lecturer on chemistry and hygiene to the London Conservatoire, consulting analyst to the Royal Commission (C.I.E.) for Victoria, the Mauritius, the Indian Museum, the West-Riding Chamber of Agriculture, etc. He had held the appointment of public analyst for the counties of Derby, Glamorgan, North Staffordshire and the Borough of Hanley. Salicylic acid was present in a very small quantity, about two and one-quarter grains per bottle. This was a proper proportion and sufficient to *prevent secondary fermentation* in the wine and to keep it in a wholesome condition. All wines containing a good deal of sugar, and but little alcohol, were liable to this change—raspberry wine especially—and *needed some antiseptic* to make them keep at all. Salicylic acid, being effective and not at all injurious to health, was *one of the very best* that could be used for the purpose. Had such a sample been officially submitted to him during his career as public analyst, he should undoubtedly have certified it as being "not adulterated."

Dr. John L. W. Thudicum said: "I am an M.D., M.R.C.S. and F.R.C.P., and scientific referee to the Board of Trade. I agree with Mr. Lascelles-Scott that the use of salicylic acid is necessary to prevent fermentation in raspberry wine, and that it is *quite innocuous.* Large quantities of the acid are used in food without any injury from it." Dr. Bond said: "I am lecturer to the College of Physicians; I have had long extensive experience in the use of salicylic acid, and I have been in the habit—when away from home hunting in the country—of taking ten grains of the acid a day for a month, *without the slightest bad effect.* The quantity mentioned as having been found in the wine could do *no possible harm* to anyone." Mr. Hay-Murray (the presiding judge): "We have given the case our best attention and consideration, and have come to the conclusion that no matter or ingredient was introduced into the wine to increase its bulk or to defraud or injure any one. We have therefore no hesitation in dismissing the case." (July 1st, 1892.) In an American court a good deal of evidence could have been produced, in opposition to the claims of some of the experts in this case, as to the need of any preservative in the raspberry wine, claiming that it could have been better protected from decomposition by pasteurization. In a later chapter this particular phase of the subject will be considered.

The opponents of modern preservatives have had much to say about the interdicting of the use of salicylic acid by the French Government. By a circular of the Minister of Commerce, dated February 7, 1881, salicylic acid was prohibited as a preservative of food. Within a few days of the issue of the circular Dr. Cornil, Professor at the Faculty of Medicine in Paris, and Director Galippe, of the laboratory of the same faculty, together with thirty-four of the highest standing medical men of Marseilles, Lyons, Nancy and Lille, signed the following declaration: "We have, up to now, not heard of the slightest accident having taken place in consequence of the use of food containing salicylic acid. In the foreign documents which we have examined there is likewise no reference to any such occurrence." Following this twenty-one of the leading physicians, college professors and hospital directors of Paris wrote to *Le Progres Vinicole:* "We are of the unbiased opinion that the present widespread and growing use of salicylated foods and beverages may not only be tolerated without hesitation by the government, but that this same use mav be even in many respects considered as denoting an ***actual progress.*** " (No. 109, Feb. 28, 1884.) In 1882 a consultative circular was issued by the entire Faculty of Medicine of Bordeaux and signed officially by Professor Denuce, the dean, in favor of the use of salicylic acid in wine, and later they issued the following declaration on the same subject:

"Université de France,
"Faculté de Médicine de Bordeaux.

"Cabinet Du Doyen:

"After due reflection and renewed investigation of the subject, I to-day confirm, in every particular, the results stated in the consultative circular drawn up by me on January 7, 1882, regarding the salicylation of wines, according to which it was concluded that:

"The salicylation of wines, in the proportion of not more than ten to forty grams (one-third to one and one-third ounces) of acid per hectolitre (twenty-six gallons), is an *excellent means* of preserving and even improving inferior wines; *it is in no way deleterious to the public health,* and its use may be justly adopted, as much in the interests of the consumer as in those of the dealer.

"I to-day maintain this conclusion.

"(Signed) DENUCE,
"Professor, Doyen de la Faculté de Médicine."
"Bordeaux, May 2, 1884."

On the 20th day of August, 1884, a final judgment was given by the Appellate Court, Bordeaux, confirming all previous acquittals, as well as a judgment releasing the salicylated wines, etc., that had been confiscated under the interdict.

Conservative opposition to innovations is confined to no particular country. Successive efforts have since been made to have the use of preservatives in wine made illegal in France, with more or less success. A strong political bias pervades the French

ion against what is chiefly made in Germany. This naturally
led to the heat of the debates concerning the interdict, but dis-
: to new methods of protecting food has been the chief element
:he affray. This is seen in the fact that even in Germany there
; arisen strong opposition against using preservatives in beer
l upon meat. The year following the settlement of the French
erdict, by the decision of the Bordeaux Court of Appeals, the
:stion came up in the German Imperial Court of Appeals (First
nal Senate), and on November 30th, 1885, a decision was ren-
·ed to the effect that the adding of salicylic acid to beer is not
adulteration (as per paragraph ten of the Food Law of May
1879), except in cases where it is proved that the addition of
s acid has caused such an alteration in the composition of the
·r as will falsify it by making a deteriorated article appear to be
ter than it really is.

A careful comparison of the relative proportions in which
cylic acid and salicylates are given by physicians to rheumatic
ients with the amounts that are ever likely to be taken in pro-
:ed foods will clearly show how insignificant the latter is. The
;est amount that any one person is likely to take will doubt-
ly be obtained from the drinking of beer. Freshly made beer,
the home market, *requires none*. Beer that has to be shipped
a distance during warm weather is most likely to contain it.
eet wines, unfortified by additional alcohol, are likely to con-
ı it. Other wines do not need it. Fresh provisions of every
d are innocent of its presence. Bread and potatoes do not
d it. An honest examination of the total amount of food one
s at any meal will show that but a trifling proportion of the
ole would, under any circumstances, ever contain a trace of it
any other preservative. If a man takes one-thousandth of a
.in in his catsup, a hundredth of a grain in his jelly or jam, a
usandth of a grain in his soda water, and from a quarter to
f a grain in his beer, cider or wine, he has reached the ordinary
it of dosage for any meal. As seldom, if ever, any person
es catsup, jam, soda water and beer, cider or sweet wine at the
ıe meal, even these small fractions cannot honestly be totalled
figuring up the daily dose that might be imbibed from food.
it is the exceptional wine, the exceptional beer and the excep-
ıal canned vegetables that contain it, the using of other wines,

beers and canned vegetables would still further reduce the total. Exceptionally heavy drinkers might, perhaps, be found who prefer unfortified sweet wines to other kinds, sweet ciders to other kinds of cider and bottled long-kept beer to freshly made beer, but they would be rare, indeed. If such men could be found their dosage of the preservative might pass the fraction of a grain, but not far. However much they drank, it would be safe to predict that the alcohol contents of the beverage would harm them long before they had reached the point where the slightest symptom could be detected from the preservative. A rheumatic patient taking from twenty to thirty grains at a dose, three times a day, will take more in a single day than a drinker of sweet wine or cider would be likely to take in a month and more than the average inhabitant of a free country would in a quarter of a year. Any such patient, if under treatment for two weeks, would take as much as he could manage to swallow in properly preserved food in three years. Dr. Stricker's summary of the action of salicylic acid in the treatment of rheumatism declares that, "It is not injurious to the human organism in the doses necessary to cure the disease." (Internat. Med. Annual, 1902, p. 54.) If it is not injurious in doses of three hundred grains per week how can it be injurious in doses of three to six grains per week? If, by some accident, two or three times as much was used in some article of food than was really necessary, so that ten to twenty grains per week might be taken, what possible harm could occur? If a larger proportion was introduced the sickish, nasty taste would render the article unpalatable. Any food stuff that contained as much as would make a small medicinal dose would immediately be rejected. Cushny says: "Salicylic acid and its salts are rapidly absorbed from the stomach and intestine, and as a general rule produce no symptoms unless when given in very large doses." (Pharmacol. and Ther., 1903, p. 414.) Of these symptoms which very large doses produce the same author tells us that they are "very indefinite and with few exceptions occur so seldom in men that they may be dismissed very shortly." (p. 415.) He gives the dose for rheumatism as fifteen to thirty grains every two or three hours (p. 419). Professor H. C. Wood tells us that it may be given as a salicylate in single doses of 100 grains. (Therapeutics, 11th ed., p. 583.) The United

States Dispensatory states that "the dose of salicylic acid in acute rheumatism may be set down as a drachm in the twenty-four hours, although it is employed by some practitioners in much larger doses." (17th ed., p. 87.) It can be seen from these authorities that we have understated, rather than overstated, the comparative amounts.

Upon several occasions, in American courts of justice, witnesses who ought to have known better, have sought to prejudice juries by calling salicylic acid poisonous and even pronouncing it a poison. These men ought to have known that no living authority on toxicology or therapeutics ever pronounced it such. Probably the nearest approach to such condemnation from a writer of any recognized authority on subjects of this kind is the following statement from an official bulletin of our government: "While they (salicylic and boric acids) are not named as active poisons by authorities on toxicology, there can be little doubt that their use in considerable quantities, or for a long period of time, would have injurious effects." (Bulletin 25, p. 55, Dept. of Agri., Bur. of Chem.) The author goes on to explain why he thinks that these acids would be injurious if long continued or in considerable quantities, and we find that it is the old theory confounding enzymes with germs that is responsible for the belief. This theory will come in for consideration in its proper place. The toxicological works of Woodman and Tidy, Clark Bell, Herold, Reese, Hamilton, Blyth and every other that the author has been able to discover in any New York library, are silent regarding the existence of poisonous qualities in salicylic acid. Herold reports cases of death from overdoses of tartaric acid and acetic acid (1898, p. 82), but none from salicylic acid. Woodman and Tidy gave cases of poisoning from acetic acid, citric acid and tartaric acid (Forensic Medicine and Toxicology, 1887, pp. 425, 433), but none from salicylic acid. These authors likewise give a long list of cases of poisoning from overdoses of alcoholic beverages. Clark Bell gives cases of poisoning from tartaric acid, acetic acid and alcohol (Taylor's Medical Juris., 1884, p. 31), but not one from salicylic acid. Late editions of these works were not available when this was penned.

In view of the fact that deaths have occurred from the use of substances so relatively harmless as tartaric, citric and acetic acids, it will be of interest to compare their dosage with that of salicylic acid. The former are consumed with impunity by the public, and it would certainly fill them with amazement, or else with mirth, if any person should show any signs of paternal interest in their well-being by warning them to avoid such dangerous (?) articles as oranges, lemons, grapes, wines or vinegar. When they learn that the essential acids of these are listed, by the most competent authorities of the world, as stronger than salicylic acid, they may well wonder at the claims of those who try to make them believe such a substance is a poison. The dose of the acid of grapes (tartaric acid) is given in the United States Dispensatory as "five to thirty grains." (17th ed., p. 105.) Cushny puts the dose of tartaric acid at five to twenty grains (Pharm. and Ther., p. 568), and that of salicylic as fifteen to thirty grains (p. 419). Butler gives the dose of salicylic acid as five to sixty grains (Text-Book of Mat. Med., 2nd ed., p. 315), and of tartaric acid as ten to thirty grains (p. 149.) All other authorities place the respective doses of these two acids in a similar relationship. With so strong an array of facts against the opponents to the use of preservatives, is it not quite surprising that they are willing to eat grapes and drink wine containing tartaric acid? Not only are they willing to consume this fruit and its fermented juice, but they are equally willing to permit of its sale to others. There can be but one explanation of this that is satisfactory. Grape eating and tartaric acid consuming have the sanctity of ages and the confidence of habit behind them, while salicylic acid creates opposition for the same reason that milk drinking creates disgust in a Buddhist, or pork eating in a Mohammedan. Permeating the whole logic of their opposition is a fallacy that needs to be touched upon here. They assume that if concentrated salicylic acid is harmful the same acid must continue to be harmful in ever so minute doses. If this is true with one acid it must be equally true with others. If minute doses of salicylic acid are bad because large doses are, then minute doses of tartaric acid must be bad because large doses are. Such a conclusion is a delusion where it is not a wilful perversion. Both acids, in small doses, are perfectly harmless. The same is true of citric acid. Its dose is placed by the United States Dispensatory at five to twenty grains (p. 49), by Butler's Materia Medica at five to twenty grains (p. 149), by Cushny's Pharmacology at five to twenty grains (p. 569), and by Hare's Therapeutics at five to twenty grains (7th ed., p. 697). Here we again observe that the authorized dose of salicylic acid is higher than that of citric acid. Citric acid is therefore recognized as being the stronger of the two. Maisch, in his Organic Materia Medica, informs us that lemon juice contains from seven to nine per cent. of citric acid (p. 341). No one objects to letting the public use lemon juice containing so large a proportion of citric acid, but there are those who seriously object to permitting a grocer's selling any article containing one grain of salicylic acid to a pound. The lemons contain seven parts in one hundred of the stronger of the two acids, while the jelly or jam contains only one part in 7,680 parts. The article that, if dangerous at all, is nearly 550 times the more dangerous, is permitted to be sold with impunity, while the one that is about 550 times the weaker must not be sold under penalties and punishments. Indeed this does not fully express the absurdity of the thing, for in the case of catsup far less would be used at a time by the consumer than would be used of lemon juice. We have no idea that lemons hurt anybody, but we are equally sure that preservatives in jams or jellies are still less likely to do harm.

Turning next to the acid constituent of vinegar, we learn from the United States Dispensatory that, in its pure state, "this acid is used only externally and acts as a rubefacient, a vesicant, or a caustic, according to the length of time that it is applied. Its application requires caution. It is sometimes employed as a substitute for cantharides, when a speedy blister is desired. It may be applied by means of blotting paper or cambric moistened with it. It is a good corrosive for destroying warts and corns." (p. 22.) And this is the acid which almost everybody takes into their stomachs daily without fear or hindrance from meddlesome authorities. If someone should be advocating its use for the first time what a howl would be heard. How unreasonable it would be to conclude that vinegar must be a very bad or a very dangerous thing to swallow in its diluted state, because that in its strong state it is so powerful. Yet this is the very kind of reasoning that is used against preservatives to frighten legislators into passing laws against them, frightening juries into condemning grocers for selling goods immensely weaker in benzoic or salicylic acid than vinegar is in acetic acid, and frightening judges into fining and imprisoning grocers and others for such perfectly harmless acts. When the pure acid of vinegar (glacial acetic acid) is diluted down to thirty-six per cent. it is still so strong that Cushny says: "In the mouth and stomach it acts as an irritant, causing vomiting, great pain, collapse, and even death." (Pharmacology and Therapeutics, p. 568.) It is only when diluted down to six per cent. that physicians venture to prescribe it for internal use. A twelve per cent. solution, if we can judge by dosage, would be about equal in strength to pure benzoic or salicylic acids. The acid of vinegar is thus seen to be eight times stronger than either of the two latter acids. On what reasonable grounds can any person condemn the use of the weak articles and condone the use of one *eight times more dangerous?* Why permit the use of vinegar in pickles and condemn the use of either of the other acids in catsup when the pickle eater will consume a hundred-fold more of the more dangerous acid than the catsup user will of the weaker ones? Is this consistent? Is it reasonable? Is it honest? The entire mass of authoritative statement, as found in the text-books used *in all our colleges and institutions of learning*, negatives the claims of the opponents of the common, popular preservatives, so far as any injury that their use is likely to produce.

If text-books on therapeutics, materia medica, toxicology, and the like, are all wrong, then where shall we look for any superior authority? If men who have personally tried the preservatives upon their own persons, men who stand high in the world of science, are not to be believed in their statements of facts, then whom are we to believe and why? If the whole experience of the civilized world, for a quarter of a century, has failed to show one instance—*only one*—in which bodily injury has come from using preserved foods, while untold multitudes have suffered torture and death from the use of *unpreserved foods,* where shall we turn for further light upon this momentous subject? The British Parliamentary special committee sought to get light upon the problem, and meagre as was the evidence laid before them in comparison with the vast amount in favor of preservatives that might have been laid before them, they were able to reach the following conclusion: "The instances of actual harm which were alleged have occurred from the consumption of articles of food and rink chemically preserved were few in number, and were not all pported by conclusive evidence. Certain medical officers of ealth admitted that they could give no cases of illness which ey had suspected might have arisen from the use of chemical reservatives in food or drinks. In other instances, however, we ere told either of isolated cases or groups of cases in which oric acid or borax was thought to have been the cause of mis-hief." (Parliamentary Blue Book, p. xxi.) This final state-ent, after months of inquiry in which virulent opponents to odern preservatives were examined, mildly lets down the men ho when first appearing were so positive, but who on cross-xamination confessed lack of other evidence than that of sus-icion. A careful reading of all the evidence fails to show a ngle substantiated case of injury. The words, "Were thought have been the cause of mischief" sums up all that the blue book ontains within its pages. Are ptomaine and toxin poisonings at occur with such startling frequency only "thought to have een" due to germ products? The total evidence is the "evidence f expectation."

About five years ago the editor of a New York medical jour-al wrote: "We are anxious to learn of any experimental work one by anyone anywhere that confirms the broad claims made y a few medical journals and by the lay press regarding the evil fects of the use of the more common preservatives, such as odium benzoate, boric acid and salicylic acid, when used in the roportions generally required to prevent putrefaction. If such vidence exists, it ought to be published for the benefit of the hole medical profession, as well as the world of laymen." After is was published a number of experiments were tried. The ost extensively quoted, and evidently the most thoroughly re-ed upon by the opposition, were those of Dr. H. E. Annett. hese were answered by Professor Oscar Liebriech, of Berlin, d by Dr. S. Rideal, of London. Counter experiments showed at Annett's experiments were vitiated by unfair conditions. ideal showed that when he used kittens of the same age as those Annett and fed them pure cow's milk they died just as An-ett's kittens died, though no boric acid or any other preservative as put into the milk. He further showed that cat's milk contains six per cent. of albumin, while cow's milk only contains three and one-half per cent., and that the very young kittens that died while taking borated milk really died as did those that took the pure cow's milk, of starvation. Rideal also called attention to the contradictory results of Annett's experiments, in that the kittens that took the most preservative in their milk were the ones that lived longest. (*Lancet*, Jan. 27, 1900, p. 230.) When older kittens were used they seemed to thrive on borated milk. Liebriech's experiments with dogs showed that they could be given amounts comparatively large in proportion to their body weight without doing them harm.

Pfeiffer and Kionka have experimented upon the use of sulphite of sodium in the food of animals and come to the conclusion that these were injurious, not noticing the fact that the quantities given in relation to the body weight of the animals were ultra-maximum doses instead of the very minute doses used as preservatives. To multiply the amount 200 or more times above that which should be used in a fair and honest experiment and then denounce as injurious argues badly for the intelligence, the honesty, or the lack of bias of the experimenter.

Probably the most interesting experiments of any ever made in the United States are those of the Department of Agriculture, with the so-called "Poison Squad." Twelve young men were chosen for these experiments under conditions that were exceedingly trying to their nervous systems. It would be hard to devise any that could possibly be worse if the special aim was to thwart the ultimate purpose. The very first thing they were asked to do appealed to their fear. They had to sign an agreement not to hold any one responsible if injury should come upon them by the experiments. Thus at the very start they had a first taste of intimidation to arouse their fear. The newspapers, by keeping constantly before them the fact that they were deemed a "poison squad," added to the evil influence upon their minds. The habit of those conducting the experiments and of those coming in contact with the young men was to speak of the preservative they were taking as "dope" and the act of taking as "doping." While those in charge may have refrained from such levity in the presence of the young men, it is somewhat doubtful, as a daily habit is not so easily overcome. The designations of the tables as "Hygienic" and "Experimental" or "Observation" were suggestive of danger to the sensitive among the subjects. The fact of their all knowing during part of the time at least when they were taking their "dope" could not but produce terror in the most sensitive and some degree of fear in all who were ignorant of the exact physiological effects and dosage of the preservative used. But the climax was capped when the preservative was given them in capsules instead of being mixed with their food. Here every condition of a reliable test was violated. Suppose the test had been regarding the effects of three per cent. of alcohol, in beer, upon the subject. Supposing over a dram of absolute alcohol, representing a quart of beer, had been given in capsules at each meal, what would have been the effect? Surely nothing like the effect of beer would have occurred. As soon as the capsule ruptured and the burning liquid touched the mucous membrane of the stomach the whole system would have received a shock. If the rupturing happened when the capsule was near the stomach wall the shock would have been at its worst, while if it happened when farthest from the stomach wall it would have been least, though still distinct. Suppose the experiment was to determine the effect of vinegar and capsules of glacial acetic acid had been used, what would have been the result? Would not the subjects have had their stomachs permanently damaged for life had they taken the equivalent of as much vinegar as is contained in a large-sized pickle? The pickle would do no harm, but the concentrated acid of that pickle given in a capsule would be a most serious affair. Fortunately for the young men on whom the experiments were tried, neither boric nor salicylic acids have the caustic properties of absolute alcohol or of absolute acetic acid. They do, however, have the irritating properties of absolute boric acid and absolute salicylic acids, and these are never given with food. All preserved foods contain the preservatives in a diluted form like the acid in vinegar and the alcohol in beer. In this form it should have been given to the "poison squad," if the true effects were what the experimenters were after. As it was, every dose taken must have slightly disturbed the stomachs of the takers. If the capsules ruptured near the stomach wall the shock would be at its worst. If in the centre of the stomach the shock would be least. If as simple a thing as a piece of candy had been given to each of them for a number of days, at every meal, and they had to swallow it undissolved and undiluted, it would have produced a sense of uneasiness in the takers. How much more, then, would boric acid and salicylic acid, the doses of which are many times less than of sugar? The medical dose of boric acid is from ten grains to one-half a dram. The experiments of the Department of Agriculture were conducted on full medicinal doses. The subjects were given from an ordinary medical dose up to double the amount usually administered by medical men. Some of the subjects were able to endure, without loss of appetite or vomiting, daily doses of about sixty grains. In some cases these symptoms occurred with doses of thirty grains. Smaller quantities produced slight disturbances after a considerable period of time, extending in some cases to fifty days. In the case of salicylic acid from fifteen grains to forty-five grains per day was the amount administered. This represents from fifteen pounds to forty-five pounds of catsup, jelly and jam per day, to be taken by those who do not consume sweet cider or beer bottled for transportation. For the latter it represents from fifteen pints to forty-five pints, day in and day out, for many days. I think the reader must agree with the author that the cider or beer, catsup or jelly, swallowed in such tremendous quantities, would do far more harm than the "dope" did to the "poison squad." The doses given were too large for elephants if their effects as preservatives were sought. If everything the young men ate and drank had been fully borated or salicylated, and particularly the latter, they could not possibly have consumed such amounts. The average consumption of a year was exceeded in a single day. In rare cases from one-fifth to one-tenth of the lowest dose might be imbibed, and continued for several days. Such cases would be rare exceptions. But what of the symptoms? Our medical works have given us the combined knowledge of medical men and medical experimenters after hundreds of tests, instead of a dozen. These report distinct symptoms from the use of boric and borates, which they describe as "borism," and of salicylic acid, which they speak of as "salicylism." These *are not* the symptoms described for the small doses by the Washington experimenters. When people get nervous about their health and dream of possible trouble or lie awake thinking about it they invariably get "a feeling of depres-

on and discomfort, attended very frequently by a dull and con-
nued headache, with a sense of fulness in the head." The
mptoms attributed to the small doses of the preservative no
edical work in the world gives as due to such preservative. The
mptoms are exactly those of nervous strain and worry. They
e the product of fear, which the young men may have tried to
ugh off, so as to appear strong and brave. Polli's eight sub-
cts, when under the same doses given in a reasonable manner,
owed no such symptoms. The multitudes of cases under medi-
l treatment have never given such symptoms as did the Wash-
gton "squad," because they were never placed under such ner-
ous tension or fear. Experiments conducted for the good of the
ce, and at such a heavy expense to the taxpayers of the coun-
y, should be conducted on a strictly scientific basis. The chemi-
l work done in these experiments, by the officers of the Depart-
ent of Agriculture, is worthy of all praise. No finer or more
tisfactory scientific work could be expected. The ability of the
en who did the work cannot be questioned. They are well-
nown throughout the country as able scientific men, but they are
ot theraupeutists nor physiologists. In this was their failure.
heir very excellence as chemists unfitted them for work as
erapeutists, a rôle which they were unfortunate enough to try
nd fill. Had they stuck to the kind of work in which they had
en trained, and for which they are so admirably fitted, no fault
uld have been found with what they did. It is their experi-
ental therapeutics that is at fault. The surprising feature of the
fair is the fact that they ever undertook such a task with any
pe of success.

CHAPTER IV.

DIGESTION AND FOOD PRESERVATIVES.

In 1836 Theodor Schwann discovered pepsin in the gastric juice. Before this discovery was made no one knew the nature of the digestive process. Three years before Schwann's discovery Payen and Perzos showed the presence of diastase in malt extract. Before their time no one knew the difference between the changes brought about in food-stuffs by germs and the changes caused by the chemical substances we now call enzymes. So recent is the general diffusion of this knowledge that most of the older men of our time gained their early education when no distinction was known to exist between fermentation by germs and the changes brought about by enzymes. More recent chemical and biological knowledge has taught us that germs are living things and that enzymes are chemical substances without life. Our older men were taught to look upon both as of a common kind, and so they called both by the common name of "ferments." In the following quotation from Salter's translation of Lafar's Technical Mycology these facts are set forth as follows: "Contemporaneous with the development of positive knowledge with regard to these bodies (the germs) was the discovery of the enzymes, the behavior of which resembled that of the former, in so far that they exhibited a capacity of inducing decomposition. Moreover, the obscurity in which these organisms were still enshrouded was equally mysterious in both cases; and, since the organic nature of the true instigators of fermentation was either unknown or was not considered worth attention by the chemists of the day, it *happened* that the name *ferment* was also applied to the *newly discovered enzymes.* With an increasing insight into the true state of the matter grew the conviction that *two very different things* had been grouped *under one name,* and this conviction found expression in the distinction thenceforward of the true instigators of fermentation as organized or structural ferments, whilst the enzymes were designated unorganized or structureless ferments. These terms are still current in chemical text-books, whereas in Fermentation Physiology it is customary to speak merely of *fermentative organisms* on the one hand and of *enzymes* on the other." (p. 22.)

This early blunder of applying the term ferment to two wholly different things is responsible for one of the most common and mischievous errors that has ever been committed in the name of science. Through it imperfectly informed food inspectors and dairy commissioners have been misled and have been inspired to mislead others into passing obnoxious laws and into executing such laws to the injury of business men who were innocent of wrongdoing. Take, for instance, the following piece of reasoning from the Minnesota Dairy and Food Commissioner's Report for 1901, where we are gravely told that preservatives "are used solely to prevent fermentation, and since the processes of digestion are fermentation processes, the chemical preservatives must work an injury." (p. 1063.) This is quoted approvingly on page 119 of Bulletin 53 of the North Dakota Agricultural Experiment Station. Thus have public funds been employed to perpetuate the pernicious blunder of a generation ago. In 1833 such reasoning could have passed unchallenged, but in the light of twentieth century knowledge it shows a lamentable lack of information on the part of the authors of both the Report and the Bulletin. But these two officials are not the only ones who have been misled by this antiquated blunder.

In Bulletin 100 of the Kentucky Agricultural Experiment Station appears the following: "The strong paralyzant power claimed for antiseptics is sufficient to condemn their use in foods, for a substance which can preserve perishable foods under any conditions, and for any length of time, will also affect the delicate digestive ferments of the stomach." (p. 100.) Let the reader note the word "paralyzant" and observe how the author of the sentence applies it in regard to the "delicate digestive ferments." That antiseptics might paralyze living organisms is quite clear, but how they could, for this reason, be assumed to paralyze a lifeless drug like pepsin is most astonishing. If they could "paralyze" pepsin, why not be able to likewise paralyze bricks, stones, metals or glass? That no mistake might be made regarding what he meant in this he quotes, in substantiation of his position, the following words as coming from an officer of the Department of Agriculture of the United States: "There is no preservative which paralyzes the ferments which create decay that does not at the same time paralyze *to the same extent* the ferments that produce digestion. * * * The very fact that any substance preserves food from decay shows that it is not fit to enter the stomach." (p. 101.) It would be difficult to understand how any intelligent chemist or physician could, at the present day, use such words as these, if we did not know the genesis of the error. Some of the simplest of known facts so completely refute such a statement that, had any person been present who would have had the kindness to say, "Doctor, you are forgetting that both hydrochloric acid and sugar paralyze the ferments that create decay," we are sure the words would never have been published. It is evident that no one had made this suggestion to him, even after publication, for we find that it was repeated at the hearing before the Committee on Interstate and Foreign Commerce on the Pure Food Bills in 1902. There he is reported as having used almost identically the same words. (Government Report of Hearings, p. 395.) Dr. Frank Billings, Professor of the Practice of Medicine in Rush Medical College, Chicago, at the same hearings testified to the fact that the hydrochloric acid in the stomach is an antiseptic, and is the thing above everything else which preserves the body against germs that enter the stomach (p. 405). So far is this antiseptic from hindering or interfering with digestion in any manner that it is an essential of normal gastric digestion. To say that because it paralyzes the ferments that create decay it must at the same time, and to the same extent, paralyze the ferments that produce digestion, is to say what every person who knows anything about the subject knows to be untrue. So manifestly untrue is it that no man of reputation dare assert such a principle as regards this acid.

If the logic that asserts that the processes of digestion are fermentation processes, and therefore the chemical preservatives must work injury, is sound, then it must follow that since hydrochloric acid is a chemical preservative it must work injury in the stomach while performing its function of digesting our food. A conclusion so outrageously unsound needs no refutation. If "the very fact that any substance preserves food from decay shows that it is not fit to enter the stomach," then sugar and salt, mustard and ginger, cinnamon and cloves, allspice and pepper are not fit to enter the stomach since they do this very thing. In the case of spices the ignorant of the past actually did oppose them on some such ground. Hemmeter, in his Diseases of the Intestines, tells us that "Voit was the first one who rightly appreciated the great importance of the spices, and showed their indispensability for nourishment, *a fact before contested.*" (Vol. 1, p. 117.)

In Bulletin 13, Part 1, of the U. S. Department of Agriculture, p. 323, appears the following quotation from a bulletin of the Agricultural Experiment Station of California: "Whatever impedes fermentations also impedes digestion, which is itself in a great degree a process of fermentation. The habitual use of wines containing antiseptics will, therefore, inevitably result in functional derangements." While it might be possible that the habitual use of wines containing some kinds of antiseptics might result in functional derangements there is absolutely no reason for the sweeping conclusion here drawn. Whatever impedes fermentation does not impede digestion, and because an antiseptic is habitually present in the stomach it does not inevitably result in functional derangements. If this were true every living creature possessing a stomach would "inevitably" suffer from "functional derangements." All stomachs, during digestion, contain hydrochloric acid and this does not "inevitably" produce "functional derangements" notwithstanding the fact that it is a powerful impeder of fermentation. The habitual use of sugar in our food does not "inevitably" produce "functional derangements," although it likewise impedes fermentation.

In Bunge's Physiologic and Pathologic Chemistry (second ed., pp. 185, 186), we are told that Maly and Emich (Monatshefte f. Chem., Vol. IV, p. 89) "affirm that the bile acids, and especially taurocholic acid, prevent the development of putrefactive organisms, and that taurocholic acid in many cases is nearly as powerful as salicylic acid and phenol. This view has been *confirmed* by Lindenberger (Bull. de la Soc. imp. des naturalistes de Moscou, 1884) as well as by Gley and Lambling. (Rev. biol. du Nord de la France, Vol. 1, 1888.)" Here we discover that the constant pouring into the duodenum of taurocholic acid and its blending with the pancreatic juice is another illustration of a powerful antiseptic chemical which does not impede digestion nor "inevitably" produce "functional derangements." Many such cases might be cited, but these are enough to prove how utterly untenable the position is that these men have taken in order to oppose the use of modern preservatives.

In Bulletin 53 of the North Dakota Agricultural Station a well-known chemist of the University of Michigan is reported as having asserted that "a food that is braced against decomposition may be found to be braced against digestion" (p. 118). If we put emphasis on the "may be" of this remark no fault can be found with it; but when it is made to do duty as evidence, that what checks decomposition must check digestion, it becomes false and mischievous, and particularly so as coming from a man who is deemed an authority on chemical subjects. When, however, human authorities put themselves in opposition to the consensus of the competent, and in opposition to simple facts of nature that even intelligent laymen can fully understand, they will be the sufferers.

In the 1902 Report of the Connecticut Agricultural Experiment Station we are told that saccharin is a preservative, and that "*for this reason,* if no other, its indiscriminate use is highly objectionable" (p. 217). The author of this report evidently forgot that sugar is a preservative, and for this reason, if no other, its indiscriminate use must likewise be "highly objectionable." Surely being a preservative is not a bad quality to possess, provided no deleterious quality is connected therewith. Merely being able to keep food-stuffs from spoiling is not a reasonable cause for the condemnation of anything. To any man of sound thought this quality would enhance, not detract, from its value. Heat and cold, sterile air and dry air are preservatives, yet no one thinks of condemning these simply because they possess preservative powers. It is evident that such confused thinking is an echo of the old ignorance that confounded enzymes with germs because both bore the common names of ferments. The author had reasoned that since saccharin will arrest the action of a "ferment" out of the stomach it must arrest the action of a "ferment" in the stomach, and is therefore "highly objectionable." The double meaning of the word "ferment" played mischief with his logic, in that ferment in the one case means a wholly different thing from ferment in the other.

Some idea of the nature of this peculiar blunder can be appreciated by the non-technical reader who is aware of the fact that in the language of the common people the poison called acetate of lead is known as "sugar of lead." There is also on the market a "sugar of milk." What would be thought of the intelligence of any person who should reason that since sugar of lead is a poison, sugar of milk being likewise a sugar must be a poison, and that "for this reason, if no other, its indiscriminate use is highly objectionable?" Yet this is exactly the kind of reasoning that has led multitudes into the belief that preservatives must necessarily interfere with digestion and injure the digestive organs. Indeed, it has led them to a still greater extreme of inconsistency in that to it is due the claim that preservatives are poisonous. Here is a sample of the reasoning by which this absurd notion has been developed: "Preservatives usually are not poisonous in the ordinary sense, like morphine, strychnine, or prussic acid, which attack the nerve centres, but are poisonous *because* they act on the digestive organs and interfere with digestion. Digestion begins as soon as the food enters the mouth, starch being changed into sugar by the saliva. Preservative materials taken into the mouth, therefore, begin at once to interfere with digestion." (Hearings on Pure Food Bills, p. 395.) Note the steps of reasoning. Preservatives stop fermentation. Digestion is fermentation. Preservatives therefore stop digestion. Whatever stops digestion is, in a sense, poisonous. Preservatives stop digestion; therefore preservatives are poisonous. This then is the citadel of strength occupied by the enemies of modern preservatives. Through such reasoning they have had laws passed making it a crime to save the public from incontestable danger and most certain causes of death and suffering. On such logic hinges the charge so frequently repeated and even sworn to in courts of justice that preservatives stop digestion; therefore preservatives are poisonous.

In the same volume, from which the last quotation was made, we are told that "Professor Mitchell (of Wisconsin) considers *any active antiseptic necessarily* deleterious to health. It retards the processes of the stomach, stopping the working of the normal enzymes or ferments" (p. 395). It is evident that the professor had been juggling with the word ferment in its two meanings, and failing to keep the two distinctly apart in his mind had reached this remarkable conclusion. It could not have occurred to him that hydrochloric acid is an active antiseptic or he would have hesitated a long time before putting himself on record as endorsing so palpably untenable a position. He should have taken a lesson of caution from the professor of Physiological Chemistry at Yale University, who declared at the same hearing: "Antiseptics do not necessarily interfere with digestion" (p. 396). His is the declaration of a gentleman who speaks from experience. Having experimented with antiseptics he knew that the logic that confounds enzymic action with the action of living germs is false. Like Professor Attfield, he might have thought that the logic had some show of reason from the ignorant standpoint of a generation ago, but that it does not accord with experience. But Professor Chittenden added that if antiseptics were used in *large enough quantities* they would, as a rule, interfere with digestion. So indeed would nearly every soluble substance. In this respect antiseptics behave like non-antiseptics. Even the physical forces when used in large enough quantities will do the same. If enough heat is used it will stop digestion. If enough cold is used it will do the same. Notwithstanding the fact that normal peptic digestion is impossible without hydrochloric acid this, too, can be added in sufficient amounts to stop digestion. Any quantity beyond 0.6 per cent. hinders digestion, and as the excess increases the digestive process is hindered more and more, till at last there is not only complete arrest, but the pepsin is absolutely destroyed by it. The opponents of modern food preservatives can search in vain for an article used as a preservative that can serve gastric digestion any worse than this. Such an illustration shows the utter absurdity of the reasoning that would forbid the use of an article as a preservative because that in large amounts it hinders digestion. It likewise emphasizes the fact that it is irrational to conclude that because a substance or an energy injures in large amount it must necessarily injure in corresponding degree in small amount. A certain degree of heat favors peptic digestion, while any degree above or below this amount will hinder it. If enough heat is used the enzyme can be destroyed beyond possible recovery. A proper degree of heat is favorable to bodily functions of every kind and any degree above or below the favorable limits brings injury. To reason that because a fire will burn that therefore all heat should be avoided is hardly deemed logical. To reason that because large amounts of preservatives can do damage that therefore small amounts should not be used is to repeat the reasoning that, in regard to heat, everybody knows to be absurd.

It has been experimentally shown that very dilute acids have the power of aiding digestion even in the absence of hydrochloric acid. (Drugs and Digestion, *New York Medical Journal,* Nov. 27th and Dec. 11th, 1886.) Oppenheimer tells us that this is not only true of pepsin, but that "very dilute acids stimulate *all* ferments to energetic activity." (Ferments and Their Actions, p. 39.) When Bartholow tells us that salicylic acid in small doses stimulates digestion (Materia Medica and Therapeutics, 1903, p. 391), he but states what has been experimentally determined as true for other acids.

In considering the subject of human digestion the three chief enzymes that must be studied in order to know the exact facts about the effects of preservatives are (1) the ptyalin or diastatic enzyme of the saliva; (2) the pepsin or albumin digesting enzyme of the stomach, and (3) the trypsin or albumin digesting enzyme of the pancreas. These three are so very much unlike in their requirements that substances which in a certain concentration may aid one of them, may, in the same concentration, injure the others. The first of these enzymes is secreted in an alkaline fluid, and performs its part of the digestion in such a fluid. (Gamgee's Physiological Chemistry of the Animal Body, 1893, pp. 23, 27.) The second is rapidly destroyed by even very dilute alkaline fluids. (Langley, Journal of Physiology, III, p. 246.) The third "works best in a weak alkaline solution." (Ferments and Their Action, p. 108.) It can work in an exceedingly weak acid solution, but any solution containing as much acid as the gastric juice (0.3 per cent.) practically extinguishes its activity. It is evident from these facts that everything that has either an acid or an alkaline reaction, unless the amount of acid or alkali present is infinitessimal, must have some slight injurious effect on one or more of these digestive enzymes. But to conclude from this that acids or alkalies in reasonable amounts can hinder digestion is to lose sight of the checks and counter-checks which nature has placed in the digestive tract to overcome all such dangers. The body has the power of getting rid of acids and alkalies by neutralizing them, and of disposing of salts by absorbing and eliminating them. Dilute solutions of salts "have a stimulating effect upon fermentative processes; above a certain degree of concentration, a retarding influence is exerted more and more, and finally a stage is reached at which the process comes to a standstill." (Ferments and Their Action, p. 40.)

Those who oppose the use of preservatives evidently lose sight of these checks and adjustments of the animal organism. These are as much a part of the physiology of digestion as are the actions of enzymes. Without them animal life, as we know it, would be impossible. At the Hearings on Pure Food Bills one witness made the statement that "Digestion begins as soon as the food enters the mouth, starch being changed into sugar by the saliva. Preservative materials taken into the mouth, therefore, begin at once to interfere with digestion" (p. 395). While preservative materials are not needed in starchy foods, and while the amount of preservative materials used in any food is rather small to do serious injury, even if it really happened to be antagonistic to ptyalin, the fact still remains that the compensating action of the body would overcome far more of the preservative than could be present in properly preserved food. The diastatic activity of the pancreas would come into play at a later stage and digest all of the starch that escaped salivary digestion. If this was not the case the disastrous results of eating an apple, or taking some fruit jelly with starchy food would constantly be in evidence, as the acid these contain would neutralize the alkalinity of the saliva and render the contained enzyme inefficient. A small piece of pickle or of lemon would do more toward arresting starch digestion in the mouth than any possible effect from preservative amounts of benzoic, salicylic or boric acids. Then again there is the check of absorption. But for this check gastric digestion would be impossible in the presence of beer, wine or liquors.

Experiments show that pepsin digestion is hindered strongly by beer containing even less than 3 per cent. of alcohol. (Ferments and Their Action, p. 96; Buchner, Arch. f. klin. Med., XXIX, 537.) Still stronger solutions practically arrest digestion, while the alcohol is present in the stomach, but, as it is absorbed rapidly and as the absorbing of it in some way stimulates digestion, the taking of liquor or beer helps rather than hinders digestion. That the compensating physiological balances of the digestive organs fully overcome all slight deviations from a perfectly adjusted food is also seen in the fact that infusions of tea and coffee would arrest digestion, if allowed full play on the pepsin of the stomach. (Fraser, Jour. of Anatomy and Physiology, XXXI, p. 469.) A consideration of these facts shows us that if more of a preservative had been taken than enough to affect the gastric ferments it still would not follow that injury was being done to the taker.

Another most important piece of evidence to the fact of the compensating power of the body, in this matter of digestion, and one that seems to prove that the act of compensating is not a losing act of adjustment, is seen in the disposal of the enzymes themselves. The ptyalin of the saliva is destroyed by the gastric juice and the pepsin of the gastric juice is precipitated by the gall. "The gall normally precipitates the pepsin; but when this function is absent—*e. g.*, in fistula—the pepsin penetrates into the intestines and destroys the trypsin to a more or less pronounced extent, and thereby the digestion of the albumin is checked." (Ferments and Their Action, p. 109.) As the enzymes are thus seen to be anti-enzymic, and that to a greater extent than are most antiseptics, it is apparent that but for the supply of proper means for their disposal they would work havoc with each other. Now let us add to these facts the further fact that experiments show that there are antiseptics that are powerfully destructive of germ fermentation yet have no appreciable effect upon enzymes.

Effront has demonstrated, experimentally, that sodium fluoride and other fluorides while checking all reproduction in yeast cells actually stimulate the action of the enzyme. (Bull. Soc. Chim. (3), V, pp. 148, 476, 731; VI, p. 786, 1891.) Bliss and Novy tell us that "unlike pepsin, a solution of malt diastase readily undergoes decomposition on standing even for one or more days. This destruction is undoubtedly due to bacteria, since it does not take place when formaldehyde is present. Consequently, the favoring action which formaldehyde apparently exerts on diastase really consists in the inhibition of the growth of micro-organisms, and hence the diastase is protected against decomposition." (Action of Formaldehyde on Enzymes, *Journal of Experimental Medicine,* Jan., 1899, p. 80.) If, as these authors tell us, the formaldehyde and the sodium fluoride have the power of putting a stop to germ fermentation, while allowing enzyme "fermentation" to go on unhindered *in the same solutions,* what becomes of the claim that antiseptics injure digestion *because* they injure germ fermentation? Bliss and Novy, in the paper cited, tell us that "A putrid solution of pepsin in distilled water one month old digests fibrin *as readily as a fresh solution*" (p. 79). While diastase is quickly destroyed by putrefactive bacteria pepsin can resist their power to an almost indefinite extent. The kindness of nature in supplying our stomachs with an enzyme having such splendid resisting power toward bacteria, instead of giving us one that, like diastase, would have been easily destroyed by these microbes, is another evidence of adaptation to our environment. Germ-laden food is unable to destroy pepsin, and so digestion can go on unobstructed even in the presence of infection. As digestion proceeds the hydrochloric acid disinfects the food, but when from any cause the flow of hydrochloric acid is impeded or arrested infection is likely to occur from food that does not contain preservatives. In such cases medical men frequently give certain antiseptics for the double purpose of stimulating a fresh flow of gastric juice and helping this juice destroy the excess of germs. One of the best of these remedies is salicin. Of it Bartholow says: "Salicin promotes appetite and the digestion—properties which it possesses in common with other bitters. It is an antiferment, and has antiseptic powers similar to quinine and salicylic acid. The latter is a derivative of salicin." (Materia Medica and Therapeutics, 1903, p. 389.) Here, then, we have a fresh illustration of a substance being able to improve the digestion, and in this instance when given in sufficiently large doses to produce therapeutic effects, in spite of the fact that it is a powerful antiseptic. Its chemical derivative—salicylic acid—would not be used in but the minutest fragments of such doses, when given in protected food.

Having now found that the theory by which it has been maintained that preservatives necessarily must injure digestion is erroneous, that experiment and experience prove that they have no such effect, that the enzymes of digestion may even be stimulated to better action by their presence, and that the digestive organs themselves may be made to do superior work when they are used, it will be well to next inquire as to what effect preservatives are likely to have upon the digestibility of the food, as distinct from the digestive power of the enzymes. Are any of the constituents of the food chemically changed by their presence so as to render them incapable of digestion in the presence of an abundance of the proper enzyme? That some such change might be possible it is easy to infer as we know that in the cooking of meat considerable change of this kind occurs. (Jour. Amer. Chem. Soc., June, 1904, p. 251.) That such a change should occur with all kinds of preservatives in all kinds of food is highly improbable. They would not all be likely to have chemical affinities for each other. That some might is equally probable. The quantity of food that could in such cases be affected in this way would only be a minute fraction of the whole. The minute proportion of preservative present in any food could only satisfy the chemical bonds of a minute amount of such food provided it was capable of at all entering into chemical union with it. Bliss and Novy, in the researches referred to, found that formaldehyde possesses the power of hardening albuminous substances so that they become difficult, or, after strong action, impossible to digest. It is evident, then, that formaldehyde can reduce, to a small extent, the nutritive value of some kinds of food. How many other kinds of preservatives have a similar power is yet unknown. Experimental evidence in this direction is lacking, and until it is obtained we can only make a guess upon the matter. But supposing it should be discovered that all of the best preservatives had the power of slightly lowering the nutritive value of the food that contained them would this be an uncompensated evil? Let us see. Brunton says: "Constipation in ordinary people is generally due to the fact that the food they take has little or none of the stimulating qualities that ordinary diet would have in uncivilized countries. * * * They ground their wheat in the hand-mill, and then baked their bread of this coarse meal, but such meal is hard and gritty, and contains a great deal of *indigestible* residue, which would tend to keep the bowels of those taking it regularly active. Nowadays we have wheat so finely ground that all the indigestible outer part is taken away from it, and we have nothing but the starchy interior of the wheat remaining." (Lectures on the Action of Medicines, p. 413.) If Sir Lauder Brunton is correct, and that he is all those people who eat Graham bread, prunes, small-seeded fruits, etc., for their medicinal value will agree, then so far would the lowering of the nutritive value of food, in the way indicated, be from being an evil that it could easily be looked upon as a blessing. We will return to the further consideration of this phase of the subject in a subsequent chapter.

CHAPTER V.

EFFECTS OF PRESERVATIVES ON THE KIDNEYS.

ONE of the principal charges made against the use of modern preservatives is that they injure the kidneys and are directly responsible for a large proportion of the diseases of these organs that are assumed to have been increasing during recent years. In Bulletin No. 100, of the Kentucky Agricultural Experiment Station, we are told that preservatives "are eliminated by the kidneys, and that such elimination gives rise to various forms of kidney trouble" (p. 101). We have searched medical literature in vain for any evidence of the truth of the latter part of this assertion, and yet in one form or another it has been bandied around as one of the chief reasons for prohibitive legislation, and for the condemnation of those who use modern preservatives in food products. That *large amounts* of any substance which in concentrated form irritates bodily tissue, should give evidences of kidney irritation during elimination is rather to be expected. The selective action which these organs display, in taking from the blood-stream soluble salts and again redissolving them in the urine, seems to indicate concentration within the kidney tissue. It so concentrated it would be fair to infer that there might occur some degree of irritation, or even inflammation, where the amount removed in a brief period is large. That distinct forms of kidney disease could arise from the excretion, in any amount, of either irritating or bland substances, is improbable. That any recognized form of kidney disease could arise from the use of submedicinal doses of any kind of substance is inconceivable. Neither directly nor indirectly can they be shown to in any way influence the production of such a result. Let us then consider the ground upon which such a claim has been advanced.

The chief advocates of the theory tell us that preservatives are foreign in nature to the human body, that they enter and leave it unchanged in their composition, that they overload otherwise heavily laden kidneys, and that this excessive work causes these organs to become inflamed and diseased. That not one of the popular preservatives are foreign to the body is evident from the fact that they are normal constituents, though in small amounts, of certain food products. Even if they were foreign to our food the mineral ones could scarcely be foreign to our drink. The water we drink, in different parts of the earth, contains all sorts of mineral constituents. The more perfect the analyses of the human body become the more numerous the substances are found that are normal to its structure. As regards the entering and leaving of the body unchanged in composition this, surely, cannot be taken as evidence that injury is being done. Water enters and leaves the body as water, yet we never hear a word of censure placed upon those who advocate its unrestricted use. If modern preservatives must be condemned because they enter and leave the body in an unchanged condition, then water, and all the mineral salts which it contains, should meet with the common disapproval. From 150 to 200 grains of common table salt passes through the kidneys each day in exactly the same chemical form as that in which it entered the stomach. All sorts of mineral substances pass through in the same manner, being taken dissolved in the water that is drunk after flowing amid the rocks and soils of various geological strata. If boric, salicylic, or benzoic acids actually did pass through the kidneys unchanged, they would be doing no more than the indigestible contents of all foods, the water necessary for the proper assimilation of food, and the salt, but a small fraction of which is needed in supplying an essential constituent of the digestive fluid of the stomach. That the organic preservatives do not pass through the body unchanged there is abundant evidence. Linossier and Lannois showed that when they had administered salicylate of sodium by the mouth a small proportion of it was never afterwards found, so that its salicylic radical must have been utilized by the system as a food. (Bull. de l'Acad. de med.. 1896; Quarterly Med. Jour., July, 1896; Medical Annual, 1898, p. 53. English Edition.) Cushny tells us that "in its passage through the tissues, salicylic acid modifies the metabolism, as is shown by the increase of 10 to 12 per cent.

n the nitrogen and sulphur of the urine." (Pharmacology and Therapeutics, p. 416.) It thus appears as probably adding to odily energy, not only through its own oxidation, but apparently y aiding in the oxidation processes of other foods. Nor do its ood offices seem to end here, for the same author informs us that nder its administration "a still more notable augmentation of he uric acid excreted has been observed, different authors estimating it at from 30 to 45 and in one instance as high as 100 er cent." (Ibid, p. 417.) Hare tells us that "Haig has proved hat the salicylic compounds all aid in the excretion of uric acid, nd thinks they relieve rheumatism in this manner." (Practical Therapeutics, p. 341.) What appears to be another beneficent function of this substance is its removing glycin (glycocol or mido-acetic acid) from the circulation. Glycin unites with it o form salicyluric acid just as it does with benzoic acid to form ippuric acid. Cushny tells us that salicylic acid "is excreted by he kidneys, for the most part in combination with glycocol (glycin), which is known as salicyluric acid, and which is strictly nalogous to hippuric acid." (Pharmacol. and Ther., p. 417.) In the British Parliamentary investigation of preservatives one entleman expressed himself as opposed to the use of salicylic cid because it was excreted from the body in a form unlike that f any product of normal urine. He was willing to permit of he use of benzoic acid because it is excreted as hippuric acid and ormal urine does contain a small amount of this acid. (*Lancet*, Nov. 25, 1899, p. 1427.) In this country a number of State Dairy Commissioners have permitted benzoic acid to be used as a preservative while forbidding the use of salicylic acid on the trength of this far-fetched and unscientific theory. Both are rganic, both are normal constituents of fruits, the medicinal doses of both are about the same, and the chemical change that oth undergo before excretion is identical. Benzoic acid releases a molecule of water while uniting with glycin to form its excreted roduct. Salicylic acid releases a molecule of water while uniting vith glycin to form its excreted product. What a stretch of the magination it must then require in order to be able to see why ne of these should be permitted and the other rejected. There is bsolutely no perceptible difference in their injurious effects upon he system so far as any experiment has ever shown. As glycin (glycocollic acid) is a precursor of urea its removal by these acids is an aid to the body in ridding itself of its waste products. (Amer. Text-Book of Physiol., p. 981; Foster's Text-Book of Physiol., p. 539.) To act as an aid to the body in this manner does not look as if these preservatives could be sources of either irritation or disease, whatever they might be able to do if present in the blood in such excess that they had no more glycin to unite with them.

We now come to a consideration of the theory that the using of preservatives overloads the kidneys. The advocates of this theory gravely tell us that the kidneys are heavily burthened with their normal work, and that, like the last straw that was said to have broken the camel's back, preservatives cause these kidneys to become inflamed and diseased. In advancing this sort of argument they seem to forget that we have two kidneys, just as we have two hands, and that while one of them usually does the greater part of the work the other is ever ready to relieve an extra strain. In experiments upon animals it has been definitely proven that at least three-quarters of a kidney must be cut away before any noticeable ill-effects or impairment of working capacity can be discerned. (Allbutt's System of Medicine, Vol. IV, p. 318.) The same author tells us that the effects even then discerned are not due to any diminution in the excreting power of the organs, but, in all likelihood, to the inability of the organ excised to produce its specific secretion. It is well known that people have lived for years with one kidney useless through disease, and the other has gone on doing duty for both. In view of such facts any talk about overworking normal kidneys is pointless.

Now, in regard to the overworking of diseased kidneys the following quotation from Prof. Edward L. Keyes, one of the best medical and surgical authorities on diseases of the kidneys, tells its own story: "I cannot terminate this study without here laying emphatic stress upon, and calling especial attention to, the value of abundantly flushing the urinary passages with bland mineral waters of the diluent variety, as a means of flooding out both pus cells and micro-organisms mechanically in many forms of chronic suppurative disease all along the urinary tract. I know of no one single agent that possesses so much power for good. The enemy is decimated by this method of warfare and can be taken at a disadvantage. I refrain from speaking the names of the mineral springs that possess this power—and there are many of them—because the commercial spirit of to-day prostitutes such utterances. * * * Distilled water does not do the work, nor does rain water. Ordinary clear spring water fails." (Trans. Cong. of Amer. Phy. and Surg., Vol. III, p. 167.) Here we learn that the very best cure that one of the best American authorities on diseases of the kidneys is able to advise is one that works such kidneys to their utmost capacity and stirs them on to greater and greater activity. He advises the drinking of "a gallon, two gallons a day, or more." It must be water containing minerals in greater proportion than in well or spring water. Not only does he force the kidneys into hard work disposing of gallons of water, but he insists upon their using a water containing minerals in abundance, so long as only a diuretic effect is produced. He is evidently not afraid of loading up the kidneys with substances foreign to the body, substances that pass through the body unchanged, as the minerals do, and substances that overwork the diseased kidneys. He advises the violation of every feature of this theory of the opponents of food preservatives and in a way that is heroic. The amount of minerals he would have medical men force through such kidneys would be vast as compared to the trifling quantity of preservatives that would be taken in preserved foods.

At the commencement of the hearings on Pure Food Bills before the Committee on Interstate and Foreign Commerce of the House of Representatives, March 11, 1902, on p. 6 of the published report, we learn that the first gentleman who appeared in support of the Brosius bill, said: "The purpose is simply that they may sail under their own colors, and if they are introducing anything which is injurious they shall be excluded, or at least, that sufficient notice shall be given in case the injury would be such as to affect but a small class of consumers, so that the invalid, for example, might have due notice or warning that he or she should take a food thinking it not to contain anything but the ordinary substances, when, in fact, it might contain a substance like salicylic acid in considerable quantities, which, if used in a drink, would be injurious to one with weak kidneys." The word "weak" as here applied to the kidneys is so hazy that it is difficult, if not impossible, to be sure of the speaker's intent. Did he mean kidneys suffering from chronic nephritis in some small degree? Did he mean kidneys suffering from a mild attack of acute nephritis? Did he mean kidneys of congenitally abnormal structure? Did he mean kidneys with but slight resisting power toward bacterial infection? Did he mean kidneys whose walls were so unresisting that they would easily collapse, as a weak child might be expected to do under a great load? The most plausible meaning one might take from such a remark, considering some elsewhere expressed opinions of the speaker, is that he referred to kidneys possessing but slight resistance toward disease. In order to fairly criticise such a remark it is necessary to know just what constitutes an inflammatory disease of the kidneys.

Dr. Keyes tells us that "modern demonstration shows in a manner which the logical mind must accept that suppuration in the kidneys, or elsewhere, is associated with the existence of micro-organisms, and due directly to their presence." Again, he observes: "Without the co-operation of microbic infection there is no suppuration in the urinary passages." (Trans. Cong. Amer. Phys. and Surg., Vol. III, pp. 149, 150.) White and Martin, in their work on Genito-Urinary and Venereal Diseases, say: "Traumatism, alteration in the character of the urine, or the elimination of irritating drugs, such as cantharides, produces congestion, but *never septic inflammation*" (p. 806). The same authors go on to say: "Micro-organisms are, then, the ***invariable causes*** of renal suppurations, and the clinical causes of congestion can do no more than make the tissues susceptible. While it is true that individual susceptibility and local predisposition render one person more liable to suppuration than another, it must not be forgotten that bacterial virulence may be so pronounced that the most healthy tissues cannot resist infection" (p. 806.) "The methods by which bacteria may reach the kidneys from below are through the urine by means of antiperistaltic movements of the ureters; by extension along the mucous membrane or the lymph channels of the ureters; by penetration into the pelvis or ureter from the tissues surrounding the urinary tract (either by a rupture of an abscess into the pelvis or the ureter, or by emigration of the micro-organisms through the walls)" (p. 806). So well known is the true cause of chronic kidney disease of an inflammatory and suppurative type that the kinds of bacteria responsible therefor are well known. White and Martin declare that "the micro-organisms commonly causative of renal suppuration are the Bacterium coli commune, the Staphylococcus aureus, the Streptococcus pyogenes, and the Proteus Heuseri."

If the elimination of no irritating drug, not even that worst of irritating drugs, cantharides, is capable of doing any worse than producing congestion what becomes of the theory that declares that such elimination, where the quantities are minute and the drugs are far less irritating, "gives rise to various forms of kidney trouble?" In what possible way, if Doctors Keyes, White and Martin have told us the truth, can the taking of a little salicylic acid prove injurious to one with weak kidneys? Even in medicinal doses, where the amount ingested is far above that which the speaker on the Brosius bill called "considerable quantities," Potter declares that "it stimulates the kidneys, at the same time disinfecting them and increasing the acidity of the urine." (Materia Medica, p. 466.) Surely no one can hold that the disinfecting of the kidneys is going to increase instead of diminish their danger from infection. It is generally understood that when we disinfect anything we save it from infection instead of infecting it. When Dr. Keyes found experimentally that neither distilled water, rain water, nor well water were available as cures for chronic suppurative nephritis, but that mineral water did the work, did it not seem as if the disinfecting properties of the minerals had something to do with the cure? Most, if not all, soluble minerals are antiseptics. Was it because the mineral waters possessed antiseptic powers as well as diuretic powers that they were superior to ordinary water or distilled water?

In acute infectious diseases, where temperature runs high, and where the blood is charged with an abundance of irritating toxins the kidneys, in endeavoring to get rid of these toxins, become highly irritated and finally inflamed. The cells of the kidneys when thus poisoned are crippled in their work of excreting. They permit albumin to pass into and fill up the tubules. When all, or a large proportion, of the tubules are plugged up by this albumin there is no further chance for excreting. This means for the patient convulsions and death. From this extreme down o the slightest irritation of the kidneys, from any cause, there are all degrees. Associated with the varying degrees comes the symptom of albuminuria, or albumin in the urine. So much stress has been put upon this symptom by badly informed physicians that the slightest evidence of the presence of albumin in the urine is taken by many persons to be a most alarming symptom. So excellent an authority as Professor Osler says: "The presence of albumin in the urine, in any form and under any circumstances, may be regarded as indicative of change in the renal or glomerular epithelium, a change, however, which may be *transient, slight, and unimportant,* depending upon variations in the circulation or upon the irritating effects of substances taken with the food or temporarily present, as in febrile states." (Practice of Medicine, p. 855.) Such slight attacks of albuminuria as occur from the partaking of food rich in albumin to those due to the taking of a cold bath, though of the most trifling importance, are frequently magnified into signs of supposed impending disaster. There are those who class such cases as nephritis or kidney diseases. Whatever produces the slightest trace of albumin in the urine is deemed dangerous by such people. The crude conception which assumes the overworking of healthy kidneys to be a cause of nephritic affections takes hold of such trivial signs and confuses them with the signs of serious Bright's disease.

When large amounts of albumin are being excreted by the kidneys, because of the presence of the toxins of some dangerous infectious disease, the combination is an alarming one and requires the utmost care. Such cases are those of true acute nephritis. Just as the skin is irritated into redness by the poison of scarlet fever and just as it peels off after the disease has wrought its mischief, so the kidneys are affected by the poisons they excrete during attacks of scarlet fever, measles, typhoid fever, diphtheria, smallpox and other such maladies. Cases of this kind need not necessarily have any connection with suppurative diseases of the kidneys. Such cases usually disappear as soon as the disease producing the toxin has reached its limit. Not a trace of injury to the kidney need be left behind. (Allbutt's System of Medicine, Vol. V, p. 303.) It is only when these organs are invaded by microbes that permanent mischief is done. While the system is suffering from the disease the kidneys require guarding from anything that might increase the irritation. In an editorial in the *Medical Record* we are told that: "As the result of many observations in acute nephritis van Noorden finds that urea, creatinin, pigments, hippuric acid, phosphates, and inorganic sulphates are excreted with difficulty, and that in the early stages water is eliminated with great difficulty." (Feb. 6, 1904, p. 217.) The same author goes on to inform us that "we must avoid meat extracts and broths and eggs, with a view of minimizing the creatinin; hemoglobin-containing foods, on account of the resulting pigments; and green vegetables, on account of the hippuric acid formed. On account of the resulting urea and phosphates, milk is to be given sparingly, and water must also be restricted."

The reader will here take notice of the extreme difference between the treatment that is necessary in these cases of acute nephritis and those of chronic suppurative disease of the kidneys. In the latter water containing minerals should be taken in abundance, and still increasing abundance, if good results are to be expected. In the acute trouble water and milk must be restricted as well as all foods that produce such substances as are excreted in the urine.

Is there any wonder then that medical men should object to food containing preservatives should any person be foolhardy enough to give such food to these cases? But what kind of cases are they? They are not cases of people that are up and around attending to their duties. They are not people with slight ailments. They are those having raging fevers and whose blood is charged with the toxins of virulent diseases. They are patients without appetite, and who in spite of coaxing refuse to take even small quantities of nourishment. They are never found among those who are drinking bottled beer, wines, ciders or other drinks containing preservatives. They are not eating meat, potatoes or fish with catsup as a relish. They are restricted in the water they may drink, and even broths and eggs are a poison to them. They are cases in which the kidney trouble is a part of a disease that has attacked the whole body. They in no way should be confounded with cases of patients whose disease resides within the kidneys. In the former, as soon as the systemic disease disappears the kidney trouble vanishes, but in the latter the kidney trouble is *the trouble,* and it remains until a cure is accomplished or the patient slowly perishes, from the slow dissolution of his kidneys, as a mass of suppuration. By confusing the two types those opposed to the use of preservatives lead themselves to think that they have made out a case against preservatives. If the poisons of scarlet fever, measles, diphtheria, and other infectious and contagious diseases, are only capable of producing intense conditions of congestion, which pass off leaving the kidneys in good, sound condition, capable thereafter of doing their proper share of work for the balance of the patient's natural life, then there should be no reason to fear that any amount of any preservative, that is likely to exist in the few articles of one's diet that require preservation, is likely to do more than produce a slight, wholesome stimulation. In the former case the veins are charged with toxin enough to set up so intense an irritation that the whole body responds to the shock in the form of a high fever, while in the latter there is not sufficient evidence of the taking of the preservative for any one to detect that it has been taken or for the enemies of such preservatives to be able, after fifty years, to point to a single case in which they dare say "Here is a man that has been injured by a preservative."

The kidney can be wounded and bruised, cut and stitched, and, in the absence of infection, return to a practically normal condition. If severe traumatisms are only capable of producing fugitive inflammations which pass off without manifest permanent harm, what danger could possibly be anticipated, with any fair reasoning, from, let us suppose, the shaking of a journey in a railway train? A severe injury to a kidney can fairly be compared to a large dose of some toxin in its effects. The shaking which the kidney receives during an ordinary journey on a railway train can as fairly be compared to a good dose of a preservative in a quart of beer. A severe blow upon the kidney would produce an injury that would, ordinarily, quickly heal. A railway journey would scarcely even stimulate the kidney to the slightest response. A heavy dose of toxin would congest the kidney as the blow did, but the amount of preservative in a day's food would have no more effect upon that organ than a trip on a Pullman car over the best laid track in America. The kidneys are far from being such delicate organs as the opponents of food preservatives seem to consider them. Their resisting power toward disease and concussion is very much like that of the rest of the body.

In the glands and mucous membranes of the intestinal tract we have a fair means of ascertaining what a bodily tissue is capable of enduring, in the way of irritation from the use of drugs, without succumbing to disease as a result. Look at the immensity and heterogeneity of doses of all kinds of medicine, for every imaginary and real disease that flesh is heir to, that is inflicted upon the mucous membrane of the stomach. Look at the oceans of liquid cathartics and the mountains of dry cathartics that are annually poured into the stomachs and intestines of the people. Note how these cathartics stimulate, irritate, and occasionally even inflame the bowels for months, years, decades, and entire periods of long lives of their consumers. No one ever thinks of charging these with being the cause of cholera, typhoid fever, or appendicitis as the opponents of preservatives charge kidney stimulation with causing specific infections of the kidneys. We purposely irritate the intestines to compel them to secrete excessively, and frequently force them to give off mucus and casts. In minute doses these cathartics have no perceptible effect, in fair-sized doses they stimulate the bowels into slow activity, in much larger doses they irritate the bowel causing griping, and in very excessive doses they inflame. (Wood's Therapeutics, 1900, p. 637.) How they act depends upon their specific power and their dose. Very small doses may even produce results the opposite of larger ones.

There is no conceivable reason why the kidneys should behave differently to substances they excrete than the intestines do to substances they excrete. In fact, we know that, compatible with their functions, they practically behave alike in such matters. The kidneys respond to rising doses of drugs that reach them just as the intestines respond to rising doses of drugs that reach them. No one knows of any reason why this should not be so. Almost every living person has, at some time in their lives, survived a heavy cathartic or an attack of diarrhea. Why then should they fear a very gentle stimulation from some exceedingly mild laxative? Almost every living person has, at some time in their lives, survived a severe dose of toxins, from measles, scarlet fever, or some one of the febrile diseases of childhood.

Why then should they fear the lesser irritation of even medicinal doses of antiseptics? If the toxins did not produce *severe* albuminuria when they were suffering from the infectious disease then is there not the less reason for fearing injury from an immensely weaker attack of a drug? Right here let us emphasize the word "severe" as descriptive of a toxin albuminuria, for there is so much unreasonable fear over the appearance of a trace of albumin in the urine that something should be done to allay it. How can small amounts be taken as indications of impending danger when "it is generally found in the urine of the new-born, and often in that of the adolescent, without signs or symptoms of any disease. In otherwise healthy adults a trace may follow slight circulatory or digestive disturbances, excesses in exercise, or immoderate indulgence in meats without symptoms of malassimilation." (White and Martin's Genito-Urinary and Venereal Diseases, p. 622.)

In Bulletin 13, Department of Agriculture, Division of Chemistry, on Foods and Food Preservatives, we are told that "authorities in therapeutics warn practitioners of medicine against administering salicylic acid to patients whose kidneys are known to be diseased, and of late years the opinion has been growing among physicians that it has a very irritating action upon these organs, many preferring the alkaline treatment of rheumatic fever on this account" (p. 299). This was published in 1887, when much of the salicylic acid of the market contained its toxic homologues, para- and ortho-creosotic acids. Since that time the market has been supplied with an article that does not contain a trace of such poisons. Dr. Charteris showed how really dangerous these products were. (Pharm. Jour. and Trans., May 2, 1891, p. 979; British Med. Jour., March 28, 1891, p. 695.) While we have been unable to find the authorities in therapeutics who have given such a warning to practitioners, it is likely that such an opinion may have developed at that time because of the impurity of much of the acid then marketed. Authorities now do warn practitioners against excessive doses in cases with diseased kidneys. Stricker, in his summary of the action of salicylic acid in rheumatism, distinctly assures us that "it is not injurious to the human organism in the doses necessary to cure the disease." (International Medical Annual, 1902, p. 54.)

In an address made before the Altona (Germany) Aerztlichen Verein, December 16, 1903, Dr. Theodor Brugsch, of the Inner Division of the Altona Krankenhaus, declares that, "Doses of three gm. (forty-five grains) of aspirin or sodium salicylate given for several consecutive days *are harmless*, no matter whether given in single doses or during the day. We have given such doses for from two to three weeks without being able to discover any pathological constituents whatever in the urine." (*Die Therapie der Gegenwart*, Feb. 1904, p. 58.) In this report he informs us that where hyaline casts and albuminuria occurred together it was *always* in cases where the kidneys were very debilitated and where the *dose was very large*. The advice he gives to physicians as the outcome of his extensive series of experiments is summed up thus: "For the therapy of acute articular rheumatism the following scheme of salicyl medication has been found most commendable: At the beginning of the attack give large doses (5-6-8 gm.) of sodium salicylate, in divided portions, through the day (in hourly doses of 0.5 gm.); on the next day, when the attack is usually broken, pass to small doses of three grams (forty-five grains) and retain these for some time, gradually then reducing to two grams (thirty grains) and finally one gram (fifteen grains). In this manner we secure the comparatively greatest effect, and *preserve most effectually the kidneys*." When the kidneys are effectually preserved under a line of treatment that begins with 120 grains per day, with final reduction, through a series of days, to fifteen grains, how can it be possible for doses ranging below one-tenth of a grain, and never likely to exceed four grains in any one day, to irritate, inflame or produce disease of the kidneys?

Professor H. C. Wood says: "The maximum daily dose of the salicylates may be set down as 100 grains, though in rare cases only is it well to give over seventy-five grains, and usually less will suffice. In chronic cases thirty grains is an average dose. The occurrence of tinnitus aurium is an evidence of systemic intoxication, and should be the signal for the lessening of the dose" (p. 583). As physicians only administer doses that are ponderous when compared with the trifling amounts given in foods in what way could the warnings of therapeutic authorities have any bearing on food preservatives? If doses of from 60 to 120 grains are harmless and only doses ranging above these are capable of producing a transient albuminuria, why so many references to kidney diseases in connection with the administration of minute fractions of these amounts? Twenty years ago, when the fight against salicylic acid began in France, the charge was first made that it produced kidney disease. (French Commission, Bull. de l'Academie de Med. de Paris, 1886, xvi.) It was at a time when few medical men adhered to the germ theory of disease, when there was much impure acid on the market, and when for political reasons many Frenchmen were bitterly opposed to its use. The effects of the creosotic acids gave an excuse for the attack, the heat of political animosity supplied the animus, and the ignorance of medical men at that time as to the true cause of kidney disease permitted the charge to go unchallenged. Now we know that no inanimate chemical substance can produce kidney disease. We also know that albuminuria is not proof of kidney disease. Then they believed that chemical bodies were the cause of kidney disease, and they thought it beyond doubt that albuminuria was evidence of such disease of an indisputable character. The ignorance of those times is finding its echo among men of America who are chiefly chemists and not physicians, but unfortunately they are being sustained by physicians who were educated at a time when no one knew the cause of suppurative nephritis.

In the quotation just made from Professor Wood's work on Therapeutics reference is made to the occurrence of *tinnitus aurium* as indicating when the taker of salicylic acid has had enough. This ringing in the ears comes on as a sign whether the patient has taken little or much. It indicates the amount for each patient that he can bear with impunity. But there is another warning which precedes this symptom. The taste, particularly of its salts, comes promptly into evidence as the medicinal dose is approached. In our reference to the experiments of Professor Lehmann, in chapter three of this work, we mention the fact that the beer he used was so strong in salicylic acid that more could not have been added without making it distinctly offensive. To add this acid, or its salts, to food in amounts that approach the concentrations in which it is administered medicinally is to enable the user to detect its presence by taste. Sir Lauder Brunton, in his lectures on the Action of Medicines, tells his students that it has a tendency to make those taking it vomit simply because of "the curious mawkish, sweetish taste that the drug has, and it may be overcome by combining it with something that is agreeable to the patient. Commonly one gives some compound tincture of cardamoms and some spirit of chloroform, but I think the taste almost better covered by the addition of a few grains of bromide of potassium. It is sometimes given along with liquorice, and many patients do not seem to object to this mixture at all" (p. 627). The acid has a sour, "mawkish" taste, instead of the sweet one possessed by the salts. Any article of food that does not itself possess a strong, distinct taste could not contain but a few grains to the ounce before manifesting this nauseating taste. A single mouthful would reveal its presence. It is thus seen that a double guard is placed in the way of any person inadvertently taking enough of this preservative to produce the slightest effect upon the kidneys. If an excess got into a food, from a blunder or accident, those who happened to taste of it would know immediately that something was wrong and would refuse to take more. The expense of the drug would keep packers from voluntarily adding more than enough to protect the food. When a mere chilling of the body with a cold bath, or the eating of an excess of beefsteak, brings on albuminuria, when doses of 30 to 100 grains of salicylic acid per day do not produce albuminuria and when the largest amount of salicylic acid usually put into foodstuffs is from a grain to a grain and a quarter per pound, how many pounds would one have to eat in a day, of salicylated food, in order to find a trace of albumin in the urine due to that cause? What would be the effect of less than fifty pounds of food per day?

It seems as plain as possible that if all the food that the biggest glutton in the world ate was salicylated to the full protected quantity it could do his kidneys no harm. So large an amount of food would be more likely to affect his stomach. No one would ever think of advocating so useless a waste of preservatives as the adding of them to food and drink that are not perishable. But a small fraction of all that the ordinary man eats and drinks is subject to such speedy decay as to require the application of an antiseptic. The time seldom comes in one's life when fresh meats, fresh eggs, fresh poultry and other kinds of fresh perishable articles cannot be procured. When these are excluded from the estimate of the amount of food containing preservatives that we are likely to eat it is clear that the total is a very small fraction of our diet. If all the preservatives could be extracted from a year's eating of a civilized man it is hardly likely that it would be enough to produce albuminuria if divided into four daily doses. If the amount annually consumed by a man who neither drinks bottled beer nor unfortified sweet wine should all be taken in a single dose, there is no reason why we should expect to find that it would cause the appearance of even a trace of albumin in his urine. In case the taker was already troubled with albuminuria due to rheumatism it might even help him to get rid of that symptom. In the American Year-Book of Medicine and Surgery, for 1899, it is stated that "P. Collingettis has studied the indications for the administration of the salicylates when albuminuria is present with rheumatism. He has found that albuminuria is a very frequent condition in rheumatism, and is present in greater or less degree in forty per cent. of cases, but in most it is but slight. In such cases there is no contraindication to the use of the salicylates, but *these help to cause the disappearance of the albumin*" (p. 81).

That immense doses of salicylic acid, in common with immense doses of balsams, spices, essential oils and many other drugs, produce albuminuria no one will deny. In this, as has been pointed out, these substances are no worse in this day than a cold bath or an excessive amount of beefsteak or eggs might be. That such slight attacks of albuminuria should leave any permanent injury behind is contrary to all experience. The fact that doses of 120 grains and upwards of a salicylate produce albuminuria has no longer the terror for a posted medical man that it had twenty years ago. The inference that doses of from a fraction of a grain to one or two grains per day ought in time to produce as much damage as one big dose never was a rational one. It would be equally reasonable to conclude that because concentrated acetic acid can cauterize and vesicate that therefore eating pickles must in time blister the lining membrane of the stomach. To propose the suppression of the use of pickles on this ground would be as reasonable as to propose the suppression of a preservative on a similar kind of inference. Even a diseased stomach might be able to dispose of considerable amounts of highly diluted acetic acid without the slightest injury. Bulletin 13, Department of Agriculture, Division of Chemistry, p. 300, contains the following statement in reference to salicylic acid. Its presence in such a work is most surprising, inasmuch as its conclusion is exactly of a kind with that we are considering. It says: "In an article of daily consumption, and in consideration of the prevalence of kidney disease at the present day, it is a matter worthy of grave consideration whether it would not be more prudent to forbid its use altogether."

It evidently never occurred to the writer of the article in Bulletin 13 that if so common an article of our diet as table salt was to be judged from its effects on diseased kidneys we would have to absolutely abandon its use. When the simple effect of the production of slight albuminuria from extremely excessive doses caused him to advise the forbidding of its use altogether what would he have advised concerning it if it had shown such evil results in such cases as experimental evidence shows against salt? The American Year-Book of Medicine and Surgery says: "Bohme has reached the conclusion, after experiments on mice and guinea-pigs and careful observation upon a number of patients suffering with various diseases, accompanied by coma or conditions similar to that of uremia, that this condition is not improbably due, at least in large part, to the *retention of chlorides in the body.* In the experiments doses of approximately two grams per kilogram of body-weight produced distinct motor disturbances, often unilateral, and a condition of stupor. In a patient suffering from carcinoma of the seminal vesicles, who exhibited typical uremic symptoms and finally died in a condition of coma with signs of dyspnœa, the average daily excretion of NaCl (table salt) was less than three grams (forty-five grains). In other cases it was observed that where the excretion of NaCl was normal (150 to 200 grains) the uremic symptoms did not appear; where it was diminished, headache, asthma, or edema, was nearly always present. In two of these cases in which an autopsy was obtained it was found that the quantity of chlorides in the liver was generally increased. Bohme therefore draws the definite conclusion that retention of chlorides in the organism, if not the only cause for the origin of uremic and comatose conditions, is nevertheless the one principally concerned; and he also calls attention to the value of quantitative determination of the chlorides in the urine in order to control, in some measure, the treatment." (1898, p. 212.) It is very easy to imagine how intense would be the opposition to any modern chemical preservative that happened to show, experimentally and clinically, such disastrous results on people whose kidneys were unable to excrete it. Here is evidence of the evil effects of common salt on patients taking, presumably, no more than the ordinary amounts found in their daily food, and yet no cry is raised against its use either as a preservative or as a condiment. The disabled kidneys refuse to excrete it, and so the patients have to endure the horrors of convulsions, coma and death. In the presence of such facts, where is the consistency or justice of those who have raised this "salicylic acid" cry?

CHAPTER VI.

PRESERVATIVES AND VITAL STATISTICS.

PRESERVATIVES are used in food to stop decay and to stop the production therein of deadly toxins and ptomaines. If they do succeed in stopping the production of toxins and ptomaines in food in which they have been placed they must thus lessen the number of deaths from that cause. As most intestinal diseases are due to germ poisoning and are therefore in the same class as ptomaine-produced maladies, it is reasonable to infer that what checks one will check the other. If food preservatives can check the multiplication of these various kinds of germs in food it follows as a result that they can affect the death rate in such afflictions quite materially. That articles of diet are common carriers of disease germs is notorious. That a few germs in a torpid condition could do less harm than the same germs after multiplication into a millionfold the number and existing in a vigorous, healthy state, would seem to be almost self-evident.

Given an infected piece of meat, fish or other kind of provisions, and given favorable conditions for the multiplication of that infection within that article until it became saturated through and through with the infection, it is evident that the dividing up of that piece of food to various members of a family is going to endanger every one of them. Given the same piece of food, having the same infection at the start, but prevented from developing that infection beyond the narrow nidus where it had started, and it is apparent that the dividing of this food to the various members of the family would only be likely to injure one instead of all of them. Given, once more, the same piece of food, with the same infection, submitted to conditions favorable to decay, and saturated through and through with the spores of ptomaine or other disease-producing germs, while part of the stock of some

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dealer, and what would be likely to happen? Let those spores float in the air and settle upon other stock of that provision dealer to there redevelop other millions from each spot where spores have fallen, and what would then be likely to happen? Would not a whole neighborhood stand the chance of an epidemic? Given now two communities, in one of which the dealer on knowing that his ice had given out, or his refrigerator had got damaged, or some other cause had established conditions favorable to the decay of his stock, but where he dared to use preservatives, as soon as the possible danger developed to his stock, and in the other, where law and sentiment forbade such treatment of such stock, what would be likely to happen in each? Would not the dealer of the second community try to sell all of his infected meat that, so far as one's senses could detect, appeared to be all right? Would not the dealer of the first community seek to save *all* of his endangered stock by using a preservative? Now, if the use of that preservative did stop the multiplication of poison-producing germs, would not the sickness and number of deaths be less from that kind of affliction in the first community than in the second? If preservatives can keep down germs then it appears to be a certainty that the dealer who under the circumstances named was permitted to use preservatives saved the community to which he belonged from many deaths and much suffering. If preservatives did not check the development of germs in this very manner no one would ever want to use them. They cost more, weight for weight, than the foods do into which they are put. No dealer would go to the expense of putting them there if they did not inhibit the growth and multiplication of germs. Germs cause diseases of the intestines, germs cause toxin and ptomaine poisoning, and germs are subdued by preservatives. These are among the certainties of science. If one dealer could stop an epidemic where his provisions endangered a community, who can say how many hundreds of dealers may in the course of their business careers be placed in just such critical conditions at least once? If in the whole civilized world but a single infection of a single article of human food had occurred, in the entire time that chemical food preservatives have been used, and if the germs of that single infection were hindered in their multiplication by such a preservative then the use of that preservative must have altered favorably the death rate to that minute amount. It thus becomes merely a question of how many times preservatives have hindered the growth of virulent germs, in foods that were eaten by susceptible people, to know just how profoundly the death rate has been affected by their use. We make no pretense at knowing how often this has occurred. We do not even claim that it has occurred once. We leave the probabilities of the case to the judgment of our readers, permitting them to settle it for themselves. We simply supply the facts, to them as a jury, and ask them to synthetize these facts to their own satisfaction.

There is another side, however, to this question. The opponents of modern preservatives give us to understand that preservatives injure the human body in various ways and to various degrees. They tell us that preservatives check digestion, irritate the kidneys and bring on various forms of disease. We have already paid due attention to their claims on two of these counts and will, in future chapters, consider the rest. It is evident that if there is anything in their contention it must lessen the amount of credit that should be placed to the account of preservatives. If preservatives kill and injure more people by their own inherent qualities than they save by their ability to suppress germs, there is a decided loss to the community by their use. If, while they are saving a thousand lives in one way, they destroy fifteen hundred lives by the other, it is clear that a straight loss of five hundred lives must be charged against them. If they save one thousand in one way and destroy one thousand in the other, then there is no gain from their use. It is only where they save lives and do less injury than the germs they suppress that good can be credited to them. Whatever harm, then, can truly be attributed to the use of preservatives must be subtracted from the good done in combating infection.

But where is the evidence of injury from their use? Do our papers give harrowing accounts of death striking down banqueters immediately after eating preserved foods and only those being injured that partook of such foods? Do they tell us of many being killed at a time from partaking of beer containing preservatives? Are such reports of almost monthly occurrence? Is it conceivable, from the known nature of modern preservatives, that events of this kind could be possible? Could any one purposely put enough salicylic acid, benzoic acid or boric acid into food that would produce such or similar results? On what sort of facts, then, can the contention be maintained that preservatives are so hopelessly injurious that they require suppression as adulterants?

If preservatives injure the health of a community to any such degree as the opponents of these substances would like to have us believe, is there not some way in which we might hope to get some evidence of so important a fact? During the Parliamentary Pure Food Investigations in England one enthusiastic advocate of suppression said that he believed that a careful examination of the statistics of those counties and cities where the Pure Food and Drugs Act was being rigidly enforced would reveal a better state of health and a smaller death rate than in counties and cities of corresponding size and conditions where no enforcement or but slight enforcement occurred. At the meeting of the Committee on Food Standards, at Hotel Wolcott, in May, 1904, the hypothetical question was put as to what would be thought of the fact if it could be shown that since the introduction of modern food preservatives diseases of the kidneys had been on the increase. As no such statistics were then produced, and as none have since been produced, it is fair to assume that they are either non-existent or else are not of sufficient forcefulness to be of value. We would welcome any show of statistics that would seem to support the contention that preservatives injure public health. Being anxious to confirm or disprove the suggestion that vital statistics might throw some light upon this question, a search was made and some results reached of a somewhat remarkable character. Surely none of the anti-preservative people will deny the fact that the very period in which food preservatives have been growing in use is the exact period in which public health has been at its best and the death rate at its lowest. That this coincidence is due to the very advancement in our knowledge of germs which made modern preservatives possible few, except anti-vivisectionists, will deny. The very knowledge which made modern sanitation possible is the knowledge which made modern methods of preserving food possible. This honorable origin of preservatives is itself significantly suggestive of their possible results. If the parent discovery revolutionized the world and brought life and health where there was before death and disease and that to such an extent as to materially lower the death rate of the whole civilized world, why should not the progeny carry on the same kind of progress? If, on the contrary, preservatives do more harm to a community than good, was not the Englishman right who suggested that vital statistics should reflect such a fact? That State or region that uses the smallest proportion of them, corresponding with their population, should show some evidence of improved public health over other States or regions where there is no restriction in their use. In the United States there are large areas where strenuous efforts are being made to suppress their use, and still others where perfect freedom is accorded the citizens in this particular. Why, if preservatives are harmful, should not the States that suppress them show a better record than the States that ignore them?

In Bulletin 86 of the Maryland Agricultural Experiment Station appear these words: "It is believed that Wisconsin has succeeded as a State in reducing the use of preservatives to a minimum" (p. 16). Here, surely, is a chance for those opposed to the use of modern preservatives to prove the truth of the theory upon which they base their opposition. Wisconsin is the banner State of their campaign, and Wisconsin should surely show a lower death rate from diseases of the kidneys and diseases of the digestive organs than New York, Massachusetts or New Jersey. By excluding nervous diseases, lung diseases, heart diseases, blood diseases, and all other diseases not directly affected by foods in which preservatives occur, it simplifies the problem. Kidney diseases and diseases of the digestive organs are the ones chiefly referred to as being caused or aggravated by preservatives. Prior to and during 1900 Michigan and Illinois ran close seconds with Wisconsin for the honor of putting a stop to the use of preservatives. In the Eighth Biennial Report of the Minnesota State Dairy and Food Commissioner we are told (p. 14) that the State law prohibiting the use of preservatives "has been rigidly enforced." We are further informed that "several persons have been convicted and heavily fined for violating it." For States having a record of this kind what do the vital statistics of the United States say? Turning to Vol. III, Part I, Twelfth Census, page ccxxvi, it is stated that, "The following table shows, for each grand group in the United States, the proportions of deaths from *diseases of the digestive system* during the census year per 1,000 deaths from known causes in the aggregate." (The figures for sex in cities and rural districts are omitted here):

NUMBER OF DEATHS PER ONE THOUSAND DEATHS FROM KNOWN CAUSES.

Grand Group.	*Total.*
1.—North Atlantic Coast region	47.6
2.—Middle Atlantic Coast region	50.0
3.—South Atlantic Coast region	62.3
4.—Gulf Coast region	56.2
5.—Northeastern hills and plateaus	52.6
6.—Central Appalachian region	53.3
7.—Region of the Great Northern Lakes	62.5
8.—Interior plateau	57.8
9.—Southern Central Appalachian region	61.4
10.—Ohio River belt	60.8
11.—Southern Interior plateau	64.7
12.—South Mississippi belt	56.0
13.—North Mississippi belt	67.8
14.—Southwest Central region	69.4
15.—Central region—plains and prairies	64.7
16.—Prairie region	73.2
17.—Missouri River belt	69.6
18.—Region of the Western plains	68.3
19.—Heavily timbered region of the Northwest	74.6
20.—Cordilleran region	61.3
21.—Pacific Coast region	63.7

A glance at the above table will show that the lowest death rate from diseases of the digestive system was 47.6 and the highest 74.6. The lowest rate was not found in the region which is the best censored of any in our country. The region with *the very highest death rate* is number 19. Turning to page cviii of the volume we are told that "Grand Group 19, heavily timbered region of the Northwest, includes parts of Minnesota, Wisconsin and Michigan." Within it are "Ann Arbor, Mich.; Appleton, Wis.; Battle Creek, Mich.; Chippewa Falls, Wis.; Duluth, Minn.;

Eauclaire, Wis.; Flint, Grand Rapids, Jackson, Kalamazoo and Lansing, Mich.; Marinette, Wis.; Owosso and Pontiac, Mich., and Superior, Wis." It is thus made evident that the region having *the very highest death rate* of any part of the United States, due to *the very class of diseases that unprotected food is likely to develop,* is the exact region where the suppression of the use of preservatives has been most strenuously pushed. Some sort of cause was at work there injuring the stomachs and intestines of the people to an inordinate degree. They had more deaths from diarrheas, dysenteries, dyspepsias and other affections of the ptomaine and decomposed food kind than any other community in our country. Whatever this cause may have been, it afflicted the residents of no other part of the United States to any such extent as it did those of this highly protected region. Germ-poisoned foods produce just such afflictions. No other region spent so much money to rigidly exclude protected foods from its citizens. Only such food as would make the most excellent culture media for germs was allowed to be sold there. The results were certainly due to some cause that allowed just such germs to multiply as food preservatives would have kept down. Is it not singular that this cause should have happened to operate to this extent only in the region where such a strict censorship existed? What was it that permitted these particular kinds of germs to work such havoc in that region? Did the censorship have anything to do with it? The harvest they reaped was a most startling one. If this showing had been on some other kinds of diseases it would have cast discredit on the region, but there would have been no such suggestiveness of cause and effect as the present association of conditions gives.

On page cix of the same volume we are told that for this region the proportion of deaths from diseases of the kidneys was *above* the average in both cities and country. The very diseases that the opponents charge upon the use of preservatives are thus seen to be the ones that increase in number in the locality where, according to their theory, the reverse should be true.

If the reader will next look at the death rate for Grand Division 16 he will find still more food for reflection. On page cvii of the official volume on vital statistics, we are told that, "This group includes most of the State of Illinois, the southern part of

Wisconsin, nearly all of Iowa, southern Minnesota, the northern part of Missouri, the eastern half of Kansas and a considerable portion of Nebraska, with that part of the Dakotas lying east of the Missouri belt." Here again we find a grouping of States in most of which the persistent activity of food inspectors and dairy commissioners, in trying to keep down the use of preservatives, has been pronounced. In this region also the State of Wisconsin figures prominently, and Illinois and Minnesota, with the Dakotas, are strongly anti-preservative. Why does it happen that the only region in the United States that could fairly be charged with coming in second in its prosecutions and persecutions of provision dealers and grocers for selling goods containing preservatives is the exact region that comes in second with its gruesome figures of destruction of human life from diseases due to germ-laden food? Why is it that just the opposite condition obtains in both regions of the condition that should exist if the suppression of the use of preservatives benefits the public health? Why, too, is it that the difference is so very pronouncedly against the truth of such a supposition? It is not merely a reversal of what their theory demands, but it is a reversal with an emphasis. It does not come as merely a very high rate, but it comes *as the highest.* It is not a region that is merely censored, but it is the region that *is censored most.* The merely censored regions give intermediate rates and the highest censored regions highest rates. Add to this the fact that the diseases are *exactly such* as would be produced by *germ-laden food or drink* and that are very unlikely to be produced *by any other cause,* and we have a combination that must puzzle such theorists to explain from their standpoint.

In the further study of the figures of the table there are a few facts that should be presented as casting some possible light on their interpretation. Natural conditions, as well as prohibitive laws, are to be expected to take part in such results. The conditions surrounding a rural community are different, so far as their food and drink go, from those of an urban one. Country people produce their own food products and rarely, if ever, resort to the preserving of them by the aid of antiseptics other than the old-fashioned ones. City people are frequently consumers of borated hams, borated butter, salicylated jams, salicylated bottled beer, benzoated preserves, salicylated or benzoated catsups, saccharinated canned corn, with many other kinds of preserved foods and drinks. If the theory is true that preservatives are injurious, this peculiar condition of affairs should make some mark upon country life for the better and upon city life for the worse. Turning again to page ccxxvi of the volume on Vital Statistics, of the United States Census, we find the following figures of death rates of males in cities contrasted with the rates for males in the rural districts:

GRAND GROUP NUMBERS.

	1	2	3	4	5	6	7	8	9	10	11
Rural...	42.5	50.6	70.2	62.3	53.6	50.4	69.0	62.1	63.6	60.2	68.4
Cities...	47.0	46.0	50.9	48.1	46.8	54.9	57.8	51.6	76.1	56.9	

GRAND GROUP NUMBERS—CONTINUED.

	12	13	14	15	16	17	18	19	20	21
Rural........	52.1	71.8	71.5	64.2	73.7	68.9	68.0	76.2	56.0	53.8
Cities........	63.0	60.8	49.9	63.2	58.6	68.8	48.9	66.6	72.1	57.6

A glance at the above figures will show the reader that in fourteen of the twenty-one Grand Groups the city rates are lower than those of the country. In only six of them are the city figures the highest. In one of the groups the city rates are not given. It appears from these figures that a man's chances are very much better for long life, so far as diseases due to germ-laden food and drink go, if he lives in the city instead of in the country. Of course it only applies to this particular type of diseases. The preponderance of fourteen over six is surely great enough to convince any person that there is some condition in country life, connected with germ-laden food and drink, that needs changing. What is it? In the figures for females, which are likewise given in the original table, they stand as twelve to eight, and thus tell the same singular tale, though with somewhat less emphasis. Let the reader not forget that these figures represent the entire population of the United States, with all its varied vicissitudes of climate, soil and social conditions. The state of affairs which is responsible for such a showing cannot be one of geography, but must be, purely and simply, due to differences that exist between rural and urban life. Let it be further remembered that they are differences which are most probably connected in some manner with what the people eat and drink.

If we again turn our attention to our first table and recall the fact that Grand Groups 19 and 16, respectively, gave the highest and next to the highest death rates of any of the other nineteen grand divisions, it will help us to understand another important point in this discussion. Let us look at the comparative death rates, in these same groups, for country and city. Taking our second table and glancing at Group 19 we see that its rural death rate is 76.2 and its urban rate 66.6. The country death rate from diseases due to germs usually borne into the body by food and drink is away above the city rate from the same cause. Looking next at Grand Group 16, we find the same state of affairs. The figures are 73.7 for the country and 58.6 for the cities. Could they have been more suggestive if they had been falsified in favor of the enemies of the vigilant food or dairy commissioners of Wisconsin, Minnesota, Michigan, Illinois and the Dakotas? While the condition of the food and drink in these States seems to be the worst in America, it is much more alarming for their rural population than for the inhabitants of Milwaukee, Minneapolis, Detroit or Chicago. The farmer's home-made pure jellies, butter, meat, poultry and other perishable provisions do not seem to bring him that immunity from intestine-invading germs that ought to be expected. On the contrary, his suffering from these exceeds that of any other inhabitant of this nation. He should certainly ask his guides and counselors, in matters of State health, to explain what this means. Why should he be afflicted so much worse than others when he is hiring more men and paying out more money to improve the character of his food and drink supplies than the citizens of other States are doing?

Curiosity has probably prompted some of the readers of this volume to wonder what States constitute Grand Group No. 1, because of its very low death rate for the class of diseases we are considering, and because its rural population stands as a very decided exception to the rule we have presented. Having found that the States with the strictest and most perfectly enforced laws against preservatives are the ones where the death rate is the highest in intestinal diseases, we might be justified in guessing that those in which an opposite condition exists might be the lowest. If we ask ourselves where preservative-treated foods are most likely to be liberally used, will the question not suggest a region where factories abound, where the daily supplies of perishable foods are bought in small amounts, where the dinner pail takes the place of the refrigerator, and where foods are purchasable that defy exposure and can generally be relied upon to retain a freedom from the flavor and smell of decomposition? In what Grand Group will we find the mills and factories of Fall River, of Lynn, of Waltham, of Waterbury, of Ansonia, of Danbury, of Bridgeport, of Lawrence, of Lowell, of Manchester, of Norwalk, of Stamford and a multitude of other towns whose manufactured products are known in every hamlet in America, as well as in many parts of Europe and Asia? The teeming multitudes of employees of these factory towns cannot afford to pay the price that is demanded for refrigerator-kept provisions, for butter fresh from the churn, and for fish fresh from the sea. The smoked, the dried, the preserved provisions that will keep in a warm dinner pail during warm weather is the kind they principally demand. Turning to page c (*i. e.,* 100) of the volume on Vital Statistics, we will there learn that all of these mill and factory towns are in Grand Group No. 1. In the States in which they are located no one interfered with a grocer for selling foods containing preservatives. There have been no fines, prosecutions or imprisonments there for protecting perishable foods from deadly decay. There are sensible laws against the use of deleterious substances in foods, but nothing more. Is it not a most remarkable coincidence—if it is only a coincidence—that such a region should show, by its statistics, so splendid a record? It leads the list of the entire twenty-one Grand Groups. Fewer people died there from diseases due to germ-laden food and drink than in any other part of the United States. But why is this region an exception so far as its country population is concerned? Instead of its farmers suffering more from intestinal diseases than its city people, the reverse of the rule obtains here. May it not be due to the fact that its country population is *not* truly rural? The farms are often not much larger than good-sized gardens. The farmer's sons, his daughters and his help spend a good part of their time at work in the factories and mills. Their lives are lived like city people, with the added hygienic conditions of country air and country exercise. While the farmers of regions far away from cities have seldom either refrigerators or ice, the New England farmers have a good supply of both. With preserved and ice-protected foods he can defy germs and maintain as good, or better, health than his city brother. He occupies the only rural region where such exceptional but favorable conditions exist, and his relative freedom from the dangers of infected food and drink is attested by statistics.

In Bulletin No. 56 of the Wyoming Experiment Station the very first paragraph says: "Much of the food for miners, herders and ranchmen must be preserved in some way for convenience of storage and transportation, and most of our towns have extensive suburbs of tin cans." By referring to page cix of the volume on Vital Statistics, we learn that Wyoming is one of the States included in Grand Group 20. This group "includes the region westward from the east base of the Rocky Mountains to the Cascades and Sierra Nevada." It contains Arizona, Utah, Nevada, most of Colorado, Montana, etc. In this region no law seeking to suppress the use of preservatives could well be enforced, even if passed. If there is a place in America where conditions appear to be more favorable for the obtaining of proof of injury from preservatives, if such injury occurs, we do not know where it is. The wild, reckless way of living, pursued by a large proportion of the inhabitants, would naturally tend to exaggerate any ill effects which theory says preservatives ought to possess. Their habits of eating and drinking, their irregular hours, their excesses, their exposure to changes of temperature, their inability to exercise ordinary care in cleanliness of food or person, because of the character of their work and surroundings, their subsisting in boarding-houses where warmed-over dishes are common, all tend to make them a mark for diseases of the digestive organs. While those who are fond of beer, while residing in other parts of the United States, could secure that of a fresh brew requiring no salicylating, now that they reside in Grand Group 20 must depend upon preserved, bottled and frequently long-kept beer. Viewed from the standpoint of the opponents of preservatives, this Grand Group should be among the worst possible for deaths from intestinal diseases and diseases of the kidneys. How do the facts bear out their theory? By looking it up on the table we have given, the reader will see that its death rate from diseases of the digestive system is 61.3. While no one would expect it to be the lowest, for the reasons given, it is far lower than Wisconsin and

Illinois, Minnesota and Michigan, and is, in fact, lower than twelve of the largest of the other Grand Groups. There are only eight of them that are lower than it. In other words, in spite of otherwise unhygienic conditions, its record in diseases of the digestive system is superior to that of over two-thirds of the rest of the United States. Let the reader, however, not imagine that statistics show any better record for a multitude of other diseases, for they do not. In pneumonia, cancer, whooping cough, etc., the rate was above the average. It is only in diseases in which germs from food and drink are the chief agents that their rate is so low. Their ordinary habits of life are provocative of all sorts of diseases, but for some reason they suffer less from diseases of the intestinal tract than do many much more favored regions. Is all this mere coincidence? Have these figures, by the irony of fate, accidentally conspired to bring discredit on the theories of those who deny all benefit from the use of preservatives? Has group after group marshalled itself through some queer streak of fate into a set of results that constitute an unconscious conspiracy to overthrow the work of these men? Who will come to their rescue and show that these figures can be interpreted in some other way more favorable to their claims?

CHAPTER VII.

PRESERVATIVES AS RELATED TO THE AGED.

THE charge is frequently made that, while the use of preservatives in food is injurious to everybody, it is particularly injurious to those advanced in life. In a number of recent prosecutions against users of preservatives this claim was made in a most emphatic manner. So-called experts testified that benzoates, sulphites, borates and salicylates, while all deleterious to the health of the average individual, are more decidedly so when given to old people. In presenting opinions of this kind to juries it is needless to observe that no attempt is ever made to substantiate such sweeping statements with any recital of facts or reference to cases. The evidence is invariably a mere surmise or inference on the part of the witness. While testifying they tell the effects that have at various times been reported as having occurred from the administration of immense doses. In every instance it is the abuse of the article to which their testimony applies and not its use. No attempt is made to enlighten the jury regarding the sizes of the doses that were necessary to produce the results described. It is always deemed enough to state that such untoward effects have been reported as having occurred. It matters not to them if jurors do not know that such effects would be impossible except under abuse. If they can only influence the jury to favor their side they do not seem to care whose liberty is taken away or whose property is destroyed. They make it a point to try and enforce the wholly false inference that small amounts affect the takers injuriously. With evident satisfaction they try to make jurors believe that the injury which large doses produce occurs, but in lessened degree, from small doses. They even try to inculcate in the minds of jurors that continued use of small doses multiplies the increments of damage until, in the long run, great damage is done. The fact that all such statements are pure romance does not disturb such experts in the slightest. Juries, as a rule, are incapable of detecting the falseness of such statements and the illogicality of the reasoning that led to their utterance. What wonder, then, that testimony of this kind has a tremendous influence upon them. Although wholly unsustained by a single fact of human experience, this kind of evidence has been repeated, again and again, in successive cases. The liberties of respectable business men have been jeopardized, and even taken away, by this kind of expert testimony, yet none of the so-called experts has ever been known to retract his statements or blush at his ignorance. These men ought to know, if they do not, that in the amounts generally used no preservative can have any appreciable effect on the human organism, no matter how long continued. If, in exceptional cases, abuse occurs, why do they not confine their efforts to putting a stop to abuses?

There is not a single one of the ordinarily used preservatives that is ever stored up in the body, as lead and mercury are, to act in overwhelming dose after accumulation. There is neither chemical nor physiological reasons for suspecting the possibility of such a thing. They ought likewise to know that, even where enough is being taken to produce an appreciable physiological effect, *the reverse of their claim is the truth.* Butler, in his Text-Book of Materia Medica, tells us that, "The influence of habit is to *diminish the susceptibility* of the organism to impressions which under normal conditions would be speedy and effectual. Only by gradually increasing the quantity of the dose can results be obtained which in ordinary circumstances require few exhibitions" (1898, p. 32). Instead of there being a steady accumulation of results, going on toward damage, there is, on the contrary, a weakening and lessening of results. The system soon comes to act indifferently toward small doses of substances so that physicians, who are compelled to use them for a long time as medicines, find that they must keep increasing their doses in order to get any effect. This is as true of the aged as of the young.

Everybody knows how the use of tobacco enables the user to consume, with impunity, an amount that at first would have sickened him. To do the body the slightest permanent harm it would be necessary to take enough of a preservative to reach the verge of tolerance and to keep at that verge for a long period of time, or else to overwhelm the body with immensely more than it could dispose of by the means at its command. Since it is a well-known fact that only doses of the size prescribed by medical men, in extreme cases, ever reach the verge of tolerance, and, since it is equally well-known that all the popular preservatives, the average single therapeutic dose of which is given as from twenty grains and upwards, are easily and quickly eliminated from the system, there are absolutely no grounds upon which to base a reasonable inference of possible injury to any part of the body from their use in foods. If the limit of tolerance in the aged, or feeble, is lower than in the young and strong, there is still no reason for inferring that the small amounts contained in the food likely to be consumed by either approaches anywhere near to their respective limits. Indeed, on the contrary, there is much reason for believing that it is always far below such limits. Only the gross abuse of any preservative could ever cause it to approach near that limit. As no one is likely to defend the abuse of anything, we would respectfully commend to the attention of those opposing the use of antiseptic substances, in foods, that this is a proper field for their efforts. Let them endeavor to check the abuse of such things and win the gratitude of the intelligent portion of the community.

While we wish to emphasize the fact that preservatives, in the amounts likely to be taken in food, have no appreciable effect upon the body, we at the same time wish to call attention to the fact that any occasional increase in the intake that might carry the amount near to a medicinal dose would, so far as old people are concerned, be much more likely to prove decidedly beneficial than the reverse. One of the most renowned bacteriologists and zoologists in the world, Professor Elie Metchnikoff, of the Pasteur Institute, Paris, declares that, "If we desired to make the phenomena of old age physiological rather than pathological, it would be necessary to reduce the evils arising from the presence of a large intestine." (The Nature of Man, p. 254.) What are the evils that arise from the presence of a large intestine and to which he attributes the general suffering and ill-health of old people? Let him answer this question. He tells us that "the human intestine contains an enormous quantity of bacteria, which, according to the recent investigations of Strassburger, increase at the rate of 128,000,000,000,000 each day. These microbes, of which there are few in the digestive portion of the alimentary canal, are very numerous in the large intestines, *i. e.,* in the lower part containing the waste material. The remains of undigested foods and the mucous secretions form a medium very favorable to the growth of microbes. This bacterial flora constitutes a third part of the human excreta." (Ibid; pp. 248, 249.) Again this author says: "The large intestine is the reservoir of the waste of the digestive processes, and this waste stagnates long enough to putrefy. The products of putrefaction are harmful. When fecal matter is allowed to remain in the intestines, as in the case of constipation, a common complaint, certain products are absorbed by the organism and produce poisoning, often of a serious nature" (p. 73). Elsewhere he tells us that: "So long as the microbes remain within the intestines very few of them get into the circulation, and with these few the organism is able to cope. While most of the microbes are confined within the walls of the alimentary canal, the soluble excretions produced by them pass through into the lymph and blood. Quite a number of different facts establish this. Thus, for instance, it has been known for long that the urine of human beings and of animals contains a series of substances such as derivatives of phenol, indol, creosol, skatol, and so forth. In certain diseases the amount of these substances greatly increases. The stagnation of the contents of the intestines increases the amount of phenol and indol. Such facts, and many others, make it probable that these substances are the products of the bacterial flora of the intestines. They are absorbed by the intestinal wall, pass into the general circulation, and may give rise to various symptoms of a more or less serious nature" (p. 251).

Is it not evident, from this statement of the case by Metchnikoff, that since the constantly active and chief source of suffering that the aged have to endure is bacterial poisoning, from their sluggish large intestine, that whatever is calculated to mitigate this evil will benefit them? It is, of course, well understood that the contents of the large intestine cannot, at present, be safely sterilized. No method yet devised can accomplish this that would not be serious for the patient. If, however, instead of pouring into this receptacle masses of food that are charged with fresh, virile bacteria, ready to reinvigorate those already present, we supply food that contains few or no new colonies, will not some benefit be gained? It is surely worth while to try and mitigate an evil even if we cannot wholly eradicate or arrest it. Is not food that will not readily decompose less likely to increase the damage done by decomposition than food that decomposes with great ease? Will not germs that the system has become accustomed to do less damage while within the intestines than freshly introduced, new germs that carry vigor and vitality from the outside world?

As a rule the teeth of the aged are very imperfect and, because of this, mastication is seldom as perfect as it should be. Bolted masses of food, containing within their interiors numberless bacteria, fail of solution in the stomach. They sometimes even pass the action of the pancreatic juice without dissolving. Neither the gastric juice nor the bile gain an opportunity to disinfect them. They carry, from time to time, multitudes of new colonies down into the large intestines and these begin their onslaught upon the less vigorous which they soon replace much to the disadvantage of the host. Food in which bacterial growth is hindered because of the presence of preservatives is, surely, less likely to keep up such reinfecting than food that is not so protected.

Even if the food of the aged was fairly well masticated the enfeebled digestive power would hinder solution. The undigested residue going on down into the large intestine supplies increased nourishment for bacteria, produces a greater amount of poisonous material, is absorbed as poison into the blood and heightens the autointoxication from which old people suffer most. Cohen, in his System of Physiologic Therapeutics, informs us that "During old age less work is done; tissues cease to grow, and repair takes place slowly. The need for food is therefore greatly lessened. It is a common dietetic error at this time to eat too much." (Vol. VI, p. 141.) If this excess that the aged eat could be made so that it would hinder bacterial growth, to the very slightest degree, it would necessarily tend to lessen that poisoning which is the first link in the chain that finally leads to dissolution. If some means could be adopted that would keep this excess of food in an antiseptic condition, all the way down the alimentary canal, and, at the same time, make it indigestible, an ideal condition would be established. Metchnikoff tells us that, "If we were only to eat substances that could be almost completely absorbed, the large intestine would be unable to empty itself, and serious complications would be produced. A satisfactory system of diet has to make allowances for this, and in consequence of the structure of the alimentary canal has to include in the food bulky and indigestible materials." (The Nature of Man, p. 75.)

Sir Lauder Brunton, in treating upon this same topic, says: "When we wish to get the bowels to act fairly and regularly we tell our patients to return more or less to a less civilized form of diet, and instead of taking fine white flour to take either whole-meal bread or bread made of flour to which has been added a quantity of bran, such as various digestive biscuits, breads, cakes, and so on. Whole-meal bread is very often sufficient to keep the bowels moving in persons who would otherwise suffer from constipation. The reason is simply that the bran, being quite indigestible, exercises a slight mechanical stimulation upon the mucous membrane of the intestinal canal as it passes down." (Lectures on the Action of Medicines, p. 414.) To the above the author adds: "The fig is a typical example of a purgative article of diet, because it contains a number of small round seeds which are absolutely indigestible. These act as a mechanical stimulus to the bowel" (p. 414). As constipation is one of the most common ailments of old age and as the charge has been made that the use of preservatives renders much of the food containing it indigestible it is really a great pity that the charge happens to be untrue. Though the condition of constipation is a very bad one for the patient, a considerable degree of this evil could be borne with impunity if the generation of bacterial poisons could be lessened or arrested. Brunton, in referring to the development of such poisons during the gastro-intestinal troubles of children, says: "In order to prevent this condition of things you may give, as I have said, various antiseptics, and amongst those I mentioned salol and salicylate of bismuth as being very useful. These two drugs go very well together. Salol, as I said, is decomposed in the intestines, and splits up into phenol and salicylic acid, both of which are powerful antiseptics. * * * These drugs are, perhaps, among the most powerful of the intestinal disinfectants, and by means of them one is able frequently to prevent a good deal of the discomfort that arises from sepsis in the intestines. You can readily see that sepsis occurring in the intestines is likely to be followed or accompanied by various general symptoms, because the products of septic change in albuminous substances are, as I have already mentioned, of a poisonous nature. Many of them belong to the class of so-called toxic amines, or toxamines" (p. 76).

Here we learn that preparations of salicylic acid are amongst the most powerful of the intestinal disinfectants and, hence, substances that are of great value to the aged in the many ailments to which they are subject. In defiance of these facts physicians have been found willing to go into court and swear to the contrary. One gentleman, of considerable national reputation, has been called repeatedly from his own State to swear against users of preservatives that he does not favor. In one recent case he had this to say against salicylic acid: "People who are working and debilitated from any cause, or who are old, or have kidney or liver diseases as a result of which the elimination of the salicylic acid is not performed, are affected by smaller doses than if strong and vigorous." The peculiar feature of this testimony is its evasiveness while appearing to a jury to be strongly antagonistic to the use of this particular substance. Whether intentional or merely due to accident the words of this witness convey two wholly different and opposite meanings to different listeners. If we quote the same sentence, but substitute the word "salt" for the words "salicylic acid," it then reads: "People who are working and debilitated from any cause, or who are old, or have kidney or liver diseases as a result of which the elimination of the salt is not performed are affected by smaller doses than if strong and vigorous." Now let the reader repeat the same sentence, but at each reading substitute successively water, butter, cheese, and meat for salt and salicylic acid and note the meaning it conveys. The meaning the jury got from the witness was that salicylic acid in some peculiar manner was very injurious to the people included in the statement. The fact is that it is no more so, within its limits of use, than salt or water, butter or sugar, cheese or meat are, within their limit of use. In no other sense were his words true, as regards salicylic acid, than they were in regard to water or butter. It by no means follows, because of this, that any one of these articles should be, in the slightest degree, harmful to the working, the debilitated, the old, or those with the diseases named. Being affected more forcibly by smaller doses, because of lowered bodily vitality, by no means signifies that there are not harmless doses of the article referred to in which such people can indulge with impunity.

We all know that the amount of food consumed by the aged and infirm is less than that consumed by the young and strong. The proportion of preserved food is lessened not only in accordance with this necessity of age and ailment, but in even greater degree, because of the watchful care of the patients themselves and of their advisers and guardians. It is thus evident that the quantity of preservatives taken, even if any is allowed, is sure to be lowered to a degree proportional to the ability of the organism to dispose of it. Conditions make this a certainty.

Every intelligent person should be familiar with the fact that the aged and ailing, in proportion to their debility, suffer from derangements of their system due to changes of the most trivial character. The clothing they wear, the food they eat, the water they drink, the temperatures to which they are exposed, require continual readjustments to meet their varying moods. Articles of food that are perfectly wholesome to others become unsuited to them. Clothing once adequate for comfort no longer meet their needs. Temperatures that they once enjoyed now bring discomfort or pain. This puts them incessantly on the alert regarding themselves and particularly as regards what they eat. The old man finds that he cannot take as large an amount of butter as when young without getting sick. He cannot eat as much beefsteak without bringing on nightmares, neuralgias and rheumatic attacks. If he tries to indulge as freely as formerly in sweets he has acid fermentation and other annoying symptoms. It is thus with every article of his diet. He must restrict himself in all or suffer the consequences of over-indulgence. Everything he eats and drinks must be regulated in proportion to his lessened requirements. As a general principle, therefore, the statement made by the witness applies to every article of food and drink just as much as it does to salicylic acid. In the case of the latter, or any other preservative, the quantity taken would be controlled and lowered by the control and lowering of the food itself. The only moiety of truth to the testimony thus given, by the witness quoted, was that the disposal of everything taken into the body by its different organs depends upon the vigor of those organs. In every case, unless there is an absolute breakdown of the organ concerned, there is a proportion in which it can dispose of anything that it is its function to deal with.

If a strong young man can dispose of 120 grains of salicylic acid in a day, without injury, and a weakly or aged man can only get rid of 40 grains with perfect safety, it surely does not follow that either would be injured by the taking of one one-hundred-and-sixtieth of the lowest of the safe doses. Ridiculous as is the supposition that while forty grains could not hurt the aged person, one one-hundred-and-sixtieth of forty grains could hurt him, this is the very assumption sought to be forced into the minds of jurors by State officers and their witnesses when opposing preservatives in court. While the jurors are unable to detect the sophistry amid the multitude of new things thrust upon them for consideration, the witnesses should be reminded of the fact that there is such a thing as perjury by implication. When these medical witnesses testify concerning a preservative they always hold as a mental reservation the fact that large medical, or even ultra-medical doses, are necessary to do the things they say the preservative, under discussion, does. As applied to such large doses what they say is generally, though not always, true. As applied to the amounts taken in food they are positive perversions of truth. Such witnesses either do not know the effects of preservative doses on the takers, or else they deliberately seek to delude the jury into rendering a verdict that is opposed to truth and justice.

In the case we have cited, another medical witness testified that salicylic acid "is liable to produce a disagreeable effect and derangement of the health, particularly in old persons," while a third witness declared that old people and drunkards "are very much affected by it." In no instance was the size of dose necessary to produce such untoward effects referred to. Since this, *and this alone,* determined the truth or falsity of what they said, there is little excuse for its omission. Only by knowing the size of the dose under consideration was it possible to determine whether what they said applied to the preservative or not. One of these witnesses testified that salicylic acid "irritates the kidneys and nervous system," but said nothing about the amount needed to do so, nor did he enlighten the jury on the fact that condiments do the same, if abused in the same manner and to the same extent as preservatives would have to be abused in order to produce any such results. Unfortunately, juries cannot know that all such statements, when applied to the cases under consideration, are gross exaggerations of the truth. They apply only to immense amounts such as are never given, and never could be given without speedy detection on the part of the taker. They have no more bearing upon the truth, the jury is supposed to be in search of, than would be the wildest fabrications of a Baron Munchausen. Every such witness ought to be stopped and asked to declare just what doses he refers to whenever he testifies of the injurious effects of benzoic acid or benzoates, sulphurous acid or sulphites, boric acid or borates, salicylic acid or salicylates. Unless this is done, the jury is as badly misled as if direct perjury had been committed. There is, however, something of an excuse for this kind of testimony in some States of the Union.

In Pennsylvania, Ohio and a few other States, the laws are so worded that an article is deemed to be adulterated, within the meaning of the acts, in the case of food: "If it contains any added substance or ingredient which is poisonous or injurious to health." Under this form of expression judges have ruled that the question before the jury is not whether there was enough of the preservative in the particular sample of food or drink to affect the health of a person. The question which they declared it to be the duty of the jury to decide was whether the preservative was present and if so, whether it was poisonous or injurious to health. In the opinion of these judges it made no difference whether the quantity found was or was not hurtful, deleterious, or detrimental to health. The fact that it was found in any quantity, however minute, was enough and the jury must bring in a verdict of guilty. It is evident that these judges either wished to force the jury to convict in defiance of justice, or else that they had in their minds some sort of ideal line of demarcation between poisonous and non-poisonous substances. The latter supposition is probably the more reasonable. If the expert witnesses had some such notion as this, then they, too, would be, through the wording of the law, constrained to ignore dosage altogether, as they would aim at getting a conviction for the use of the article, whatever the dose. But here a humane individual would at least seek to have some sort of reasonable and thinkable conception as to what they mean by a poisonous or an injurious substance. To be the means of convicting a respectable fellow-being through some sort of vague, illy-defined idea that may, after all, because of its very vagueness, be a delusion, ought to grate on the consciences of such witnesses. They should all be ready to exactly define what they mean by an injurious as distinct from a harmless substance and between a poisonous as distinct from a non-poisonous substance. To swear away the liberty of another, and, perhaps, to bring financial ruin upon him as well as imprisonment, is a most serious affair. To do this on a vague idea that cannot be put into words is a crime. As experts they ought to know what they are testifying to. With the judges it is different. They are not supposed to be so thoroughly posted in matters that involve scientific knowledge. As they view the matter there are certain substances that are intrinsically injurious to health, or poisonous, and that when the law was framed these, and these only, were intended to be included in the definition. Assuming that judges who have made such rulings, as those referred to, are reasonable beings, it is plain that they could not intend to make the jury convict in unreasonable cases. Had a baker been put on trial for selling a pie the crust of which contained lard, had it been clearly shown that an ounce of lard would bring on a severe fit of dyspepsia, and that a much smaller amount would have brought on such an attack of illness upon an aged or feeble person, would the judge have been justified in charging the jury to find the man guilty, if the evidence showed that the lard was an injurious or poisonous substance, and that lard, in ever so small an amount, was present in the pie? Lard or butter, in amounts of one or two ounces, are unquestionably, in a sense, injurious. These substances, if abused, being injurious to health, are in this sense poisonous. No one, however, deems them intrinsically injurious, and no one would think of calling them poisons. On the other hand, if we take arsenic, we discover that, to the public mind, it appears as an intrinsically injurious substance and everybody calls it a poison. If any person should add arsenic to an article of food it is clear that they would be violating the provisions of the law. In such a case it would be useless for any lawyer to plead that the quantity used was so small that no harm could come of it. Arsenic is too dangerous a substance to permit of its promiscuous use in food. Judges deem it intrinsically or inherently injurious and poisonous. If this is a correct illustration of the judicial view, and it is impossible to conceive of any other that would credit them with honesty, honor, or fairness, then the question to settle in the minds of such judges, and to the satisfaction of jurors, is as to which of these two classes preservatives belong. Are they injurious in the sense that butter or lard are injurious, or are they injurious in the sense in which arsenic is injurious? Can they honestly or fairly be classed among substances that, like lard, are injurious in large amounts but perfectly harmless in reasonable amounts, or must they be classed as belonging to substances which are considered inherently dangerous and poisonous? This is the issue, and on it must stand or fall the claims of those using preservatives. On this issue the use of spices was fought in the past, and a victory won against conservatism and unenlightened sentiment.

Hemmeter, in his work on Diseases of the Intestines, tells us that "Voit was the first one who rightly appreciated the great importance of the spices, and showed their indispensability for nourishment, *a fact before contested.*" (Vol. I, p. 117.) The essential oils, to which these owe their virtues, are antiseptic and preservative to such a degree that they were, in only the strength in which cinnamon and cloves contain them, used to embalm the dead. Every argument made against preservatives bears with equal force against spices, yet Professor H. W. Wiley says of the latter: "Nature has wisely provided that anything which is palatable excites the activity of the digestive organs, and spices and condiments of all kinds are used to give flavor to foods, and hence to increase the activity of digestion." (Hearings before the Committee on Interstate and Foreign Commerce on Pure Food Bills, 1902, p. 258.) These spices are antiseptics, preservatives, medicines, and belong to precisely the same chemical group of aromatic substances as benzoic and salicylic acids. Their doses are about the same. The one is absolutely no more injurious or poisonous than the other. It is utterly impossible for any human being to frame a definition of injuriousness or poisonousness for benzoic or salicylic acid that will not include every known spice, and it is equally impossible for them to frame a definition of harmlessness and non-poisonousness that will embrace the spices which will not at the same time embrace these acids. We now come to the question, what is a poisonous substance? In order to be sure that the definition is sufficiently comprehensive and yet not too much so, let us also try to ascertain what a non-poisonous substance is. What substances can we properly declare injurious to health, and what substances can we, with equal propriety, pronounce non-injurious to health? The fact must not be lost sight of that in the broad sense everything we eat and drink is injurious to health and, therefore might, by a stretch of meaning, be deemed poisonous. Like the valley and the mountain there is a merging, yet as no one ever blunders in distinguishing between a valley and a mountain there should be no blundering here. Substances that injure and substances that poison, in the sense that the law implies, should not be confused with substances like spices, butter, lard, cheese, sugar or salt, the gross abuse of which can produce injurious or poison-like symptoms. In seeking definitions for these words we must not have a definition for injuriousness or poisonousness that will include any article of daily use as an ingredient of food among civilized men. What characteristic belongs to all substances usually called non-injurious or harmless?

What characteristic is absent from all substances usually classed as injurious and harmful? What is there that is peculiar to substances that every person agrees is poisonous? What is there that is absent from substances that every person agrees is harmless? Is it not true that every substance usually called non-injurious or harmless is one that is capable of being taken with safety in quite material or palpable quantities *after* swallowing the full quantity in which it is ordinarily used? Is it not equally true that every substance that everybody recognizes as injurious or poisonous is one that cannot be taken in material or palpable quantities *after* swallowing the full quantity in which it is ordinarily used? Who can urge any sound objection against making these characteristics the proper definitions by which to know what are and what are not poisons? That such definitions fully cover the cases is at once seen by applying them to concrete examples.

If we take strychnine and ask if it is a poisonous or injurious substance we see that, after a person has taken the usual dose, for him to proceed and take, on the top of that dose, a palpable or material amount, such for instance as five or six grains, the effect would be fatal. The same is true of all substances that are conceded by every person to be poisonous or injurious substances. Can any persons, after taking an ordinary dose of morphine, corrosive sublimate, atropine, prussic acid, potassium cyanide, or digitalin, proceed at once to take an additional dose of five or six grains, and suffer no injury? Such substances are deemed intrinsically injurious and poisonous. Public safety requires that they be restricted in their use and hemmed in with unusual precaution.

If we next take butter or lard, in the usual amounts in which these are taken, and at once proceed to add to such an amount so palpable a quantity as five or six grains, not the slightest ill effects will come from such an addition. No one calls tartaric acid a poison. This is the acid derived from grapes. Although the abuse of such an acid would produce injury just as the abuse of butter would yet it meets the requirements of our definition. If it is given in full medicinal doses the addition of such a palpable or material amount as five or six grains could easily be taken without the slightest injury. The same is true of citric acid. As we have elsewhere shown, the principal preservatives can be taken in very much larger doses than can these acknowledged non-poisonous fruit acids. After a full ordinary dose of a preservative has been swallowed a very much larger and more palpable addition can be immediately taken without the slightest harm than could be taken of the fruit acids. As our definition of a poisonous or injurious substance excludes the acids of grapes and lemons, as well as all the spices, it cannot help excluding the most commonly used preservatives. As our definition of a non-injurious and non-poisonous substance includes the acids of grapes and lemons, as well as spices, it likewise necessarily includes the preservatives referred to.

If these definitions are defective in any particular, those who assert that preservatives are injurious and poisonous should show up the defects and supply us with definitions that cover their contention. In serious legal cases no one should be allowed to play loose with words that are likely to be misunderstood, and that the user himself cannot place a meaning upon. When on oath one's words should at least have the virtue of not deceiving. In legal cases no witness should be permitted to appear as an expert who uses words with a looseness that is dangerous to others. They should be forced to either abandon their use, or distinctly explain what they mean when using them. The definitions here presented have the merit of lucidity and distinctness. They include nothing that should not be included, and exclude nothing that should not be excluded. They can be graphically illustrated by a chart made to scale, thus bringing conviction through the sense of sight.

With a chart five feet long divided into spaces of two inches each, and every single space made to represent one grain of salicylic or benzoic acid, the sixty spaces would stand for a dose of either of these acids, of thirty grains. One-half the length of the chart would represent one ordinary dose of the acid of grapes or the acid of lemons. This would be fifteen grains. On the same chart, drawn to exactly the same scale of dosage; such poisons as arsenic, corrosive sublimate, morphine, atropine, nicotine, aconitine, prussic acid, digitalin, etc., would have to be placed upon spaces of but a small fraction of a single inch. After one has swallowed enough preservative to be represented by five feet of chart they can turn around and immediately swallow enough more to require another foot of chart space to represent it, without the slightest fear of injury. But should the same person take only enough of any one of the poisons to represent a small fraction of an inch upon the chart, and then follow this with enough to represent twelve inches more of the chart, the result would be death. Such a chart shows, in a most pronounced manner, the very decided and unmistakable differences between poisons and non-poisons. It can likewise be used to show the relative places of substances that are on the border land of danger by their possessing properties that will not permit of a dose of a few grains being immediately increased by five or six grains without dangerous results following their administration.

While the doses for aged and feeble people are usually somewhat below the doses for the young and the strong, there is never a descent of such magnitude as to necessitate any alteration of the definitions given. In every case and at every age they are applicable.

Without the definitions here given, as to what constitutes injurious or poisonous substances, the adulteration laws of Ohio and Pennsylvania are either unreasonably unjust or decidedly obscure. With these definitions they become perfectly reasonable and perfectly just. Thus interpreted the ordinary food preservatives find their proper places and are seen to be no more injurious than spices or condiments and, by virtue of their antiseptic powers, quite as useful. With the aged and feeble their use is restricted just as the food is restricted, and the same relative harmlessness is maintained as with the young and strong. In the case of the particular preservative that the so-called experts, already quoted, condemned so lustily, there is an unusual amount of evidence that contradicts their assumptions.

An honest examination of the medicinal virtues of salicylic acid will show any unbiased persons that, so far from being injurious to old people, in the majority of instances, it could only be a benefit to them even if administered in very much larger amounts than it is ever taken in food. Most old people are, from time to time, attacked with spells of fever, racked with many and mysterious pains, annoyed with flatulence, tortured with rheumatism, gout and lumbago, suffer from headaches, eyeaches, and nervous irritability, and are tortured with various types of fermentative dyspepsia. They are all subject to feeble heart action, and have their blood loaded with uric acid. Finding this state of affairs among old people what substance do authorities in therapeutics tell us is among the best, if not actually the best, to relieve any one or all of this train of unpleasant symptoms coincident with senile degeneracy? If we open Stevens' work on Modern Materia Medica and Therapeutics at where it treats of salicylic acid, we learn that this remedy relieves pain, checks rheumatism, and lessens the liability to heart troubles. (1903; p. 393.)

Turning next to Butler's Text-Book of Materia Medica, we are informed that this same substance checks putrefactive fermentation and flatulence. (1898; p. 319.) Bartholow, in his Materia Medica and Therapeutics, assures us that besides having these other virtues it reduces fever. (1903; p. 396.) Hare, in his Practical Therapeutics, declares that it relieves lumbago, sciatica, headache, nervous irritability, and tonsillitis, besides ridding the body of uric acid. (1898; p. 341.) In no work on therapeutics have we found that any of the symptoms peculiar to the aged contraindicate its use. Even in the presence of Bright's disease, as we have elsewhere in this volume shown, its antiseptic qualities help keep down the ravages of bacteria.

In 1899 the British Government appointed a committee of noted men, some of whom were physicians, to inquire as to the use of preservatives and coloring matters in food. In 1901, after holding many meetings, consulting many experts, and studying an immense amount of evidence, their report was presented to both Houses of Parliament by command of his Majesty King Edward. In this report, the committee made, as its very first recommendation, "That the use of formaldehyde or formalin, or preparations thereof, in foods or drinks be absolutely prohibited, and that salicylic acid be not used in a greater proportion than one grain per pint in liquid food, and one grain per pound in solid food." If any evidence had been presented to this eminent body of men during their long investigation of this subject that showed danger to people of advanced life, in its use, is it at all likely that they would have placed such a stamp of approval upon its use as to fix an amount in which they were willing to see it used in the British Empire? (See British Blue Book, p. 30.) A most significant point in regard to this acid, and one that confirms the judgment of the Parliamentary Committee, is given by Cushny, in his Pharmacology and Therapeutics, where he tells us that "no such convulsive action as occurs under others of the aromatic series has been observed under it." (Third Ed., p. 416.) Experiments made to determine the physiological effects of very large doses have shown that other members of the aromatic group cause convulsive symptoms, but salicylic acid does not. As benzoic acid is one of the other members of this group, this shows salicylic acid to be even less active on the central nervous system than it is. Facts like these go far toward showing the ridiculousness of the opposition to the use of this substance as a preservative. Professor LaWall, in the *American Journal of Pharmacy*, says: "The cry of 'salicylic acid' has so influenced the popular mind that many persons are under the impression that the substance in question is an injurious product of solely artificial origin, and that its physiological effect is but slightly less injurious than that of arsenic itself. It would no doubt surprise many of these persons to learn that an ordinary wintergreen lozenge contains as much salicylic acid (combined as methyl salicylate) as the average tumbler of jelly which has been preserved with this substance; but such is certainly the case, as any one who desires may verify for himself." (Oct., 1904, p. 478.)

CHAPTER VIII.

MISCELLANEOUS OBJECTIONS TO PRESERVATIVES.

IN an article upon "The Use and Abuse of Food Preservatives," which appeared in the Year-Book of the Department of Agriculture for 1900, occur the following words: "The presence of chemical preservatives may often be taken as an indication that food products have been prepared by shiftless, slovenly, uncleanly, and generally inefficient methods" (p. 552). In Bulletin No. 100, of the Kentucky Agricultural Experiment Station, we are told that "Manufactured goods sometimes remain on the shelf for years before all of the stock is sold. Foods are often produced in unclean surroundings and handled carelessly. Such reasons, with the tendency to imitate, and to put upon the market articles of food without regard to their quality, purity, or food properties cause the use of antiseptics" (p. 99).

It is an exceedingly easy matter for any one to make charges against articles or persons that are disliked, but when such charges are made in official publications they should be sustained by some show of evidence, however weak. What evidence is there that the presence of chemical preservatives may at any time be taken as an indication that the food products in which they are found have been prepared by shiftless, slovenly, uncleanly, and inefficient methods? Granted that methods that are slovenly, shiftless, uncleanly and inefficient are used by some people who likewise use preservatives, where is the proof that the presence of the preservatives is any evidence of such slovenliness, shiftlessness, or uncleanliness? What if foods are often produced in unclean surroundings and handled carelessly? Does the use of chemical preservatives, any more than the use of refrigerators, sun drying, smoking, salting, pasteurizing, sterilizing, or canning, give encouragement to uncleanliness or shiftlessness. It is quite true that uncleanliness and shiftlessness do encourage the multiplication of germs, and equally true that chemical preservatives prevent their further multiplication. Indeed, it is because absolute cleanliness is impossible that there is any use for preservatives of any kind, but to confuse this fact with the idea that overcoming the results of uncleanliness is encouraging uncleanliness, when done by chemical preservatives but not when done by other processes, shows an utter misconception of the situation and of the subject. We can hardly believe that it could be intended as wanton and malicious perversion on the part of government officers. It is because there are so many sources of infection and so much unavoidable uncleanliness, from which the public should be protected, that any method of protection is desirable.

Why it is that this objection to the use of modern preservatives has been urged so frequently it is difficult to conceive, unless bias has been permitted to run riot with judgment. The most filthy food stuffs, put up regardless of cleanliness or care, are rendered innocuous by being sterilized, but the dirt is there just the same. This is true, though to a slightly less degree, when the same kinds of goods are protected by the use of modern preservatives. The opprobrium in neither case can be honestly applied to either method of seeking to save the innocent victims from the dangerous consequences of the uncleanliness or slovenliness. Many people will do their work, even when that work consists in the handling of other people's food, in lazy, dirty, and shiftless manner. They do not stop to consider consequences, but act from sheer force of habit and from a desire to get through with it with the least possible effort. This way of working existed before there were any modern preservatives used, and will continue to be pursued even if every modern preservative is suppressed. No one method of protecting food from decay can encourage such carelessness and slovenliness any more than any other method, so that all that any of them can accomplish is the wholly worthy end of protecting users from the direful consequences. The cooking of food has for ages protected civilized man from infection, and while it has not saved him from the partaking of the filth and dirt of the slovenly and careless it has saved him from an incalculable amount of suffering and death. It would be just as reasonable to charge to cooking the encouragement of uncleanliness, carelessness, shiftlessness, and laziness as to charge such conditions or their encouragement to chemical preservatives. If the cutting off of the consequences that could have followed such conduct is an encouragement of such conduct then it applies with as sweeping force to cooking as it does to using preservatives.

In Bulletin No. 86 of the Maryland Agricultural Experiment Station we are told that "By the use of antiseptics it is the vendor and not the consumer who is benefited, as articles which are not fresh are made to appear so, and to continue this was an injustice to the consumer and the seller of the fresh article" (p. 26). In Bulletin No. 13, Department of Agriculture, Division of Chemistry, this same idea is expressed in regard to beer, in the following words: "The use of artificial preserving agents not only introduces foreign matters into the beer which are more or less injurious, according to the nature of the material used, but also serves to cover up and hide the results of unskilful brewing or unfit materials; giving to the public for consumption a liquor that, if left to itself under natural conditions, would have become offensive to the senses and putrid with corruption long before it was offered for sale" (p. 297).

In these quotations we have another aspect of the same claim that preservatives encourage uncleanliness. Here they are accused of aiding the dishonest by permitting them to palm off filthy and impure goods under the deceptive claim that they are good and pure. By a process of logic that inverts facts conclusions of this kind become possible. The answer to all such charges is simplicity itself as soon as the nature of the changes that lead to putrefaction are fairly well understood. One of the most lucid replies to such charges appears in the Report of the British Parliamentary Departmental Committee on Preservatives where the following question and its answer are presented: "When you see cider going wrong, do you add salicylic acid? No; I would not do that. I would do it *before,* if at all" (Q. 7318, p. 255). Prior to putting this question, the same gentleman was addressed as follows: "Q. Are we to gather from your evidence that you do not think that a proper regard for cleanliness would prove a substitute for the use of preservatives? A. No, I do not think it would. Certainly, cleanliness is of the utmost importance—it is a great thing. We use our racks and cloths, and a washing machine, with two men to do nothing else than cleanse the plant and utensils, and we have special machinery for doing it, because it is absolutely necessary that the plant should be kept clean" (Q. 7313, p. 255).

A hazy understanding of the part played by modern preservatives, in protecting food supplies, inevitably leads to crude conclusions regarding what they can and what they cannot do. In the article already referred to on "The Use and Abuse of Food Preservatives," we are told that "Food preservatives are not used for the purpose of killing the germs that cause the decay of food. That would require an antiseptic of such a nature and in such quantity as to be distinctly dangerous to health and life. It would require such drastic measures as are employed by surgeons in disinfecting their instruments. The agents recommended by dealers for cleansing dairy utensils, when used in the quantity directed, only paralyze the germs and delay their action for a time. They can in no sense fill the office of plenty of sunshine and steam or boiling water. The use of antiseptics can no more take the place of careful, cleanly work in the preparation of foods and the cleansing of food receptacles than cheap perfumery can replace soap as a toilet article." (Year-Book of the Dept. of Agric., 1900, pp. 552, 553.) This is all very true as far as it goes, but it is stated in such a manner as to lead the unposted reader to derive a wholly false idea therefrom. Only those unfamiliar with bacteriology are at all likely to imagine that preservatives, as used in foods, are strong enough to kill germs. All that is hoped that they will accomplish is the arresting of their multiplication. All kinds of perishable foods are good culture media for microbes. The adding to the food of a minute amount of an efficient preservative makes it an unfavorable soil for their cultivation.

During the brief period that a meal is upon the table, or exposed to the air, the sowing of germs is going on. Both bread and meat get a liberal supply from the floating dust of the air. The meat being one of the very best of materials for such germs to grow upon it takes but a short time for *one germ* to multiply into millions. If after such exposure the meat is put into the refrigerator, and the air therein is too cold to favor their propagation, no such multiplication occurs. That piece of meat is, however, sown over with the infecting germs that cause it to putrefy, and, if specially poisonous forms were in the air at that time, it is on the verge of becoming positively dangerous to life. The fact that it carries germs of putrefaction, from this slight exposure, makes it differ from a piece of rotten meat only in regard to *the number* of germs that it carries. At the slaughter-house, in the transportation wagons, and refrigerating cars, and at the butcher shop, the sowing of the germs of putrefaction upon its surface was going on. If allowed to remain long enough, in a warm place, every one of these germs would have developed into millions. When thus developed they would have permeated it, through and through. By being kept at a low temperature they cannot multiply but very slowly and some kinds not at all. When kept frozen there is practically no multiplication of any of them. But freezing does not kill them. It is evident from this that the use of refrigerators "can no more take the place of careful, cleanly work in the preparation of foods," and in their care, than can antiseptic preservatives. The same is true of every other process of preservation. The antiseptic, as used in food, can only do for that food what the refrigerator does, *i. e.,* keep the surface germs, that are present on all food that has been exposed for the briefest moment to the air, from growing, multiplying, and developing inward to the very centre of the supply. Each restrains and holds their numbers down to appreciable figures, instead of letting them mount upward many millionfold.

Our bodies can cope with a few of even the most dangerous, but there is a limit to our resisting power of their pathogenic and poisonous character. The bread we eat and the water we drink are just as certainly sown with germs as is the meat that putrefies. Indeed, since bread and water are subject to more exposure, and more reckless exposure, than meat, the chances are that they usually contain far more surface-sown germs than are ever present on fresh meat. But bread and water are unsuitable soil for the rapid multiplication of germs. When preservatives are used on perishable foods they change such foods so that they become, like bread and water, resisting to germ growth and germ multiplication. In this way the numbers are kept down to a point where bodily function can overcome them and their poisonous products. In this overcoming of them the normal resisting capacity of every individual is quite large, but it varies materially with different individuals. We are constantly swallowing these putrefactive germs in our food and drink, but it is only under favorable conditions that even the most dangerous ever reach such numbers as to menace life. In the presence of preservatives they cannot do so. After meat, beer, wine, cider, or other perishable foods have become infected through and through with germs it is then *too late*, and quite a senseless proceeding, to add a protective agent. It is only before new crops have begun to grow and multiply that it is worth while to add preservatives.

After decay has begun it can be held from proceeding farther by any process that checks the development of germs, but there is no process known to man that will turn back decay to a point any nearer freshness than the point where it was arrested, whether by sterilization, pasteurization, freezing, or adding preservatives. No one of these processes can do any more toward improving the appearance of decayed goods than the other. None of them can make decayed goods look any more fresh looking than the other. In the case of meat a sulphite may restore lost oxygen to the oxyhemoglobin, before decay has set in upon the cells, but the moment decay has begun its power to restore the red color is at an end. Beer that has started to decompose can be held from further decay, but cannot be made fresh again. It is this arresting of decay that has been misrepresented and misunderstood. If preservatives were permitted there would be no need of stopping decomposition that had already begun. In beer that had to be kept exposed to warmth preservatives could be added when such beer was perfectly fresh and it would remain so until drunk. All the blame of doctoring decayed goods belongs upon the people who oppose the use of preservatives and not upon those favorable to the use of preservatives. But for the restrictions of those who object to the use of preservatives there would be no rotten goods to doctor and no imposing upon the public, as now, by palming off partly decayed goods for perfectly fresh ones. But few attempts are ever made, by state chemists, to detect, expose, or punish this kind of fraud. It is a much easier task to detect preservatives, and the latter kind of work brings more pay and more glory. As things now are, in all states where the use of preservatives is forbidden, there is an incessant temptation placed upon dealers to market their partly decayed goods. Does any person suppose that goods of this kind are often voluntarily thrown away or destroyed when they to all superficial inspection appear to be fresh? Is decomposing beer, when it is just beginning to show signs of decay, usually emptied into the sewer, or is it repasteurized and recharged with carbon dioxid? Are apples, grapes, and other fruits that have been started to market without antiseptic care, usually destroyed or recalled as soon as decomposition has set in? Is any kind of provisions or of beverages destroyed during incipient decay? What becomes of such goods in states where the use of preservatives is forbidden? Is it not fair to assume that most of them are sold and consumed in this condition?

In the Report of the Hearings on the Pure Food Bills, at Washington, in 1902, appears the following statement: "He (Mr. Thomann) has frequently found brewers unwilling to ship beer for long distances because they were opposed to using preservatives and could not guarantee that their beer would keep. On this ground brewers declined to send their beer to the Paris Exposition." Dr. H. W. Wiley confirmed this assertion "by saying that the almost universal response from brewers who were invited to make exhibits of beer, at the Paris Exposition, was that they were unwilling to send their beers to be placed on exhibition for perhaps six months, and afterwards tested by a jury, because their beers contained no preservatives, but were only pasteurized, and could be kept by that means for not more than two or three months" (p. 407).

What a sad commentary this is upon the wholesomeness of American beer that comes up to the standard set by the opponents of preservatives. Can they not, or will they not, see what this implies? Pasteurized beer must begin to deteroriate from the moment it is exposed to the temperature of an ordinary room. Spores start to grow and keep growing as long as that beer is out of a refrigerator. It must, in the nature of things, keep getting worse and worse every day. It is only a matter of a few days or weeks from the time it leaves the brewery until it "has become offensive to the senses and putrid with corruption" unless consumed at some point of corruption just below that which the senses reveal. Until the germs have multiplied to millions neither taste nor smell can detect them, but while multiplying they are there just the same and the drinker is putting a strain upon his health by consuming them. To be consistent the opponents of modern preservatives should have laws enacted compelling brewers, and dealers in beer, to surrender to some state official, for destruction, every barrel, or fraction of a barrel, of beer that has not been continuously in cold-storage and that is over two weeks old. The same should apply to bottles that contain no preservatives. To overlook this menace to health while prosecuting those who use preservatives seems a trifle inconsistent.

The charge that unskilful brewing is to blame for the "giving to the public for consumption a liquor that, if left to itself under natural conditions, would have become offensive to the senses and putrid with corruption long before it was offered for sale" is putting the matter pretty strongly, as there are really no such beverages ever made. The implied condemnation of beer that will not keep after pasteurization as being due to unskilful brewing is hardly true to fact. The most skilfully brewed beer will go the same way if exposed to a warm climate or kept at the summer heat of our own climate. It would require three or four times pasteurizing, at intervals of a number of days, to make beers, wines, or ciders absolutely sterile, but such treatment would injure their quality and very materially increase their cost to consumers.

Aseptic beer, aseptic wine, and aseptic foods is an ideal that it is worth our while to work towards. If it was possible to reach such an ideal no one would quicker defend the effort at trying to reach it than the author of this volume, but such an effort is perfectly Quixotic. The trouble with such an effort is exactly of the same type as the trouble that confronts all ultra-practical measures. Only impractical theorists can give such a problem the slightest careful attention without discovering that the prohibiting of the use of antiseptics as preservatives is a choosing of the greater of two evils. Practical people can sympathize with any effort that is aimed at bringing us near to the ideal, but they cannot sympathize with measures that increase human suffering, increase the cost of living upon the poor, diminish the wages of the poor, and augment the tendency to intemperance in the community. All of these the opposition to preservatives is accomplishing.

It is all right to invoke the police power of the state or nation to check the unfair competition of adulterated goods, to stop deceptive representations regarding the quality of goods, and to forbid the sale of dangerous and unwholesome goods, but it is not right to permit of the wholesale restricting of home and foreign commerce because certain gentlemen have theories that run counter to the freedom of such commerce.

If we are to be controlled by unsubstantiated theories why not let the vegetarians forbid all commerce in meats of every kind because they believe them to be injurious to public health? Why not sustain the total abstainers with laws against the use of alcoholic beverages of every strength? These people are just as sure that alcohol is a poison in any quantity, however minute, as are the enemies of preservatives that they too are poisons. Why not pass laws in favor of the ideas of those who consider tea a poison? Why not forbid the sale or use of tobacco on the same grounds? Any of these theorizers can advance just as cogent reasons in support of their notions as can the opponents of preservatives. Indeed, there is a common family resemblance between them all. We freely acknowledge that there are both pros and cons to this question of preservatives, and in weighing these it is the part of wisdom to choose the practical side with its maximum of good and minimum of evil, rather than the ideal side that satisfies our weakness for trying to reform things into perfection, even if it brings a harvest of pain and death. This same problem of aseptic versus antiseptic conditions has had to be met by medical men, and while they all acknowledge that the aseptic condition would be vastly superior to the antiseptic, sane judgment has compelled them to curb their desires for perfection. They insist upon aseptic surgery where reasonably possible, but willingly consent to the use of antiseptic surgery where the ideal is impossible.

What would be the effect of passing laws to forbid surgeons using antiseptics because the ideal treatment of wounds is an aseptic one? Every medical man knows that such laws would not only be absurd, but that they would be criminal. Aseptic conditions can only be carried out under favorable conditions, and they must be supplemented by antiseptic treatment in order to do the best possible for humanity. Much as the surgeons of the country might wish to treat every wound aseptically it is practically impossible. State laws compelling the use of aseptic measures or none would be little less unreasonable than the present laws concerning the treatment of perishable foods by aseptic measures or none.

In Bulletin 100 of the Kentucky Experiment Station we are told of boric and salicylic acids that "recognized experiments show them to be antidigestive and accumulative" (p. 101). So utterly foreign to the known facts is this statement that when the author first read it he thought it must be a deliberate perversion on the part of the writer of the Bulletin cited. Later, Rideal's book on Disinfection and Disinfectants appeared, and on page 203 was found the following: "There seems evidence to show that, like lead and arsenic, it (salicylic acid) has a cumulative action." Following this came the statement of Vallin that "if a man consumes an average quantity of salicylated foods and drinks as met with in France he would absorb per day three grammes (forty-five grains) of salicylic acid." It is quite safe to say that Vallin either knew nothing about the nature of salicylic acid or that there was an error in his calculation. A grain of salicylic acid is enough to preserve a pound of solid food, and the same amount is quite sufficient for a pint of any beverage. More than one-half of all the food any person is likely to eat will keep perfectly without any preservatives. Even the great bulk of the perishable food and drink is consumed so soon that it would be a senseless waste to put any upon it. Jellies or jams, catsups or relishes, wines or beers, constitute the total food supply that is likely to contain salicylic acid. Occasionally a sausage or Hamburg steak might contain it, but this is very unlikely, as other preservatives are usually applied to these. Supposing all of the articles named contain this acid, is it probable that any one human being is going to consume forty-five pounds of them in a single day? If we figure upon an extreme allowance of three quarts of wine or beer per day and two pounds of all the other articles, this would only give eight grains of the preservative. Even this amount is grossly in excess of all likelihood. Now, if we further suppose that every handler of such goods ignorantly put in between five and six grains, where only one grain was needed, then the taste of the food would be so badly affected that few would be willing to eat any of it. The sickish taste would have nauseated most of the partakers. Again, the taking of forty-five grains in a single day would have made the ears ring like the taking of a large dose of quinine. Can any person believe that the people of France ever tolerated such an abuse of this preservative? If Vallin told the truth then has he not shown conclusively that salicylic acid is an exceedingly harmless article to use since manyfold the necessary amount was being used, in a wholesale manner, by the French people, and nobody was complaining except a few agitators? If the whole French nation was being treated to such excessive amounts, day after day, then what becomes of the charge of cumulativeness that Rideal introduces, not as coming from Vallin, but in such close proximiity to the statement of this gentleman as to suggest such a source. It is remarkable that Rideal should say, "there seems evidence to show," and yet, in a book designed to give all the evidence on the subject, advances not a speck. He must have known that there is no evidence to show anything of the kind except that advanced by Brouardel, nearly twenty years before, and that subsequent research had completely overthrown. He ought to have known of the bitter animosity to everything German that existed in France when Brouardel made his charge. The Franco-Prussian war was at that time fresh in their minds, and it was an astute piece of politics to fight what was then chiefly a German product. That Rideal seems to have had the early statement of Brouardel in mind is seen in the fact that the same page of his book refers back to and quotes from the edict that interdicted the use of the acid in France at that time, and which we have referred to elsewhere.

When Brouardel made his charge it was reported in this country by the *Druggists' Circular* in the following words, which it quoted from the *Medical Times and Gazette:* "When salicylic acid is introduced into the system it is eliminated by the kidneys and liver, and, while young and healthy persons may take even quite large doses for a number of months without perceptible bad effects, there are other persons who cannot bear even small amounts for considerable time. Under the most favorable conditions not all the salicylic acid is eliminated, a portion undergoing decomposition within the body *or being retained in the tissues.* Any disease or idiosyncrasy which impedes free elimination gives rise to an accumulation of salicylic acid in the system which may prove fatal" (July, 1884, p. 105). Let the reader critically scan these words and take notice of the fact that the assumption of possible cumulativeness is based solely on the fact that "under the most favorable conditions not all the salicylic acid is eliminated." In order to appear fair he does say that this may be due to "a portion undergoing decomposition within the body," but he threw the weight of his influence to the wholly gratuitous assumption that it was retained in the tissues. After making such a statement his conscience, if not his scientific pride, must have been prodding him for twenty years and trying to force him to get some facts with which to justify it. The challenges that have repeatedly been sent out defying him and his disciples to show evidence of any injury from the use of this article was an implied denial of his claim of cumulativeness. Surely a crisis must come sometime with somebody, if an accumulation was going on. Where was there a single such case to be found? No friend of his ever came to his rescue except to repeat his unfounded charge, as Rideal and the writer of the Kentucky Experiment Station Bulletin have done.

At the International Medical Congress, at Madrid, in 1903, Brouardel appeared in person and read a paper on this subject. According to the report, published in the Journal of the American Medical Association, he said: "The elimination of salicylic acid or its salts is rapid in the young, but *it is likely to be slow* and even prolonged for days in the aged or infirm and in pregnant women or young children" (Vol. XL, p. 1303). Now let the reader compare Brouardel's words of 1884 with his words of 1903 and see how, while clinging for so many years to the gratuitous assumption he made when a young man, he now finds himself compelled to tone the whole business down to the words *"likely to be."* If he has been properly reported he does not even dare to say that elimination is slow in the aged and infirm. He evidently knows that there is no evidence within his reach, after a search of twenty years, that is worth the trouble of presenting to a congress of his peers. He no longer even presses the point that the incomplete elimination is evidence of retention, being probably aware of the results of Byanow and others in this particular direction. Byanow found that salicylic acid was not only excreted as salicyluric acid, but that some of it left the body in the form of salicin, and the evidence he had indicated that part of it, like sugar, probably changed into oxalic acid (Central. f. Chirur., 1877, p. 809).

It has been a constant complaint of physicians that the effects of treating with salicylic acid lacked permanence. As soon as the remedy is stopped there is a cessation of its action. With most drugs there is a persistence of the effect because the body retains enough to keep up the action. This is not so with salicylic acid. Bartholow, in his Materia Medica (1898, p. 317), informs us that this is due to the rapidity with which it is eliminated from the system. Had the enemies of preservatives taken an opposite stand and claimed that the effects of the acid were such that the body rebelled against its presence and hastened to get rid of it, they could have more easily sustained their contention. It is eliminated with such rapidity that the doctor who wishes to complete a cure must keep up giving the remedy to the last in order to maintain its action. A more unhappy choice, for a charge of cumulativeness, could not well have been made. No wonder that Dr. Brouardel was so very much less positive in his assumption after twenty years of advancing knowledge. "If it had been cumulative, the fact that nearly everybody has been absorbing the methyl ester of salicylic acid during their entire natural lives, in fruits, in candies, in dentrifices, in preserves, in many articles of food, while multitudes have been taking it in immense doses as a medicament for pains of every kind, for diabetes and for other affections, the evidence by this time should be so overwhelming against it that no one would dare contradict the statement" (*New York Medical Journal,* Jan. 30, 1904, p. 207). If there was the slightest foundation in fact for this charge of cumulativeness, what a pitiful spectacle tens of thousands of American adults and children would present, who are fond of eating wintergreen berries, as an article of food, of chewing wintergreen leaves, as well as the bark of sweet birch, that are so common in our woods and on our hillsides. If Brouardel had been right these multitudes should have had such an accumulation in their tissues by this time that they would all have been chronic invalids.

Here we are reminded of another statement of Rideal's upon the same page of his book (p. 203). He says, "Nessler observes that 'salicylic acid is not a natural constituent of any food, and its addition is a fraud on the quality.'" This certainly speaks badly for Nessler's knowledge. Any New England school boy could have told him of the use of wintergreen berries as a food. Messrs. Traphagen and Burke, of the Montana Agricultural Experiment Station, have found it in strawberries, raspberries, blackberries, currants, plums, cherries, apricots, peaches, grapes, crab-apples, apples and oranges (Jour. of Amer. Chem. Soc., March, 1903). Will either Dr. Rideal or Dr. Nessler assert that these are not foods? Not only is it found in the natural food supplies of human beings, but likewise in that of all manner of animals as well. In the form of its methyl ester and also in its kindred form of salicin it has been under consumption since geologic times. Schimmel and Co., probably the largest manufacturers of essential oils in the world, declare that the methyl ester "appears to be one of the most widely diffused odorous principles in the vegetable kingdom." (Semi-annual Report, April, 1900.)

For many years the Annual Reports of the Agricultural Laboratory of the Botanical Garden, at Buitenzorg, Java, have been giving reports of the researches of their chemists in which they have discovered this substance in order after order, genus after genus, and species after species, of the vegetable kingdom. So multitudinous are the number of species, remote to each other botanically, that have been found to contain it that the list would fill a page. Is a substance so widespread cumulative and injurious when every form of life on the planet must partake of it? To say that the quantity likely to be consumed from such sources is very small is to demolish the very argument that has been made against this substance as a preservative. If it is cumulative no quantity of it is too small to accumulate. If it is not cumulative, then the quantity used as a food preservative is too small to hurt any one. If the amount in fruit is too small to injure any one, where is the point in which freedom from injuriousness resides? To acknowledge that there is any such point is to upset the continuous contention that the thing and not the dose is the essential point to oppose.

Since the year 1900 a number of authors have declared that physiological experiments of recent date had shown that salicylic acid should not be used in foods under any circumstances. A statement of so sweeping a character surely ought to have some sort of foundation in fact. It was bad enough for Brouardel to guess that it might have cumulative effects, because it was not all eliminated unchanged in the urine, but to claim that evidence resulting from physiological studies tended to condemn its addition to foods under all circumstances appeared to the author to be either a very great departure from truth or else the physiological work referred to had not been published as broadcast as it deserved. In order to get at the truth of the matter letters were at once dispatched to these authors, in which occurred the following words: "Will you kindly do me the favor of giving me some, or, better still, all the references in your possession in this direction. A compliance with this request will be highly appreciated and esteemed a great favor." References were returned of various kinds. Some of them were to others that had repeated the same statement without evidence, some to writers who had said just the reverse, and every correspondent gave among his references the Year-Book of the Department of Agriculture for 1900, p. 557. It was quite evident that the statement in the Year-Book was the source of their information. Under date of November 13, 1903, the following was written and sent to the author of the Year-Book statement:

"In an investigation which I am making of the literature of Salicylic Acid as a Food Preservative, I have just finished reading your paper in the Year-Book of the Department of Agriculture for 1900, on The Use and Abuse of Food Preservatives. On page 557 you say: 'Since 1880 the mass of the evidence resulting from physiological studies with salicylic acid tends to condemn the addition of this substance to foods under all circumstances.'

"Will you kindly direct me to where I can find the evidence to which you refer? If you will be good enough to do so you will make me very much your debtor."

This communication was mailed in a stamped envelope containing a return address, but remaining unanswered until December 8th, a second letter was written to Professor Bigelow that read as follows:

"On November 13, 1903, I wrote to you, but fear you did not receive my letter, as I have had no reply. I am looking up the literature on Salicylic Acid, particularly in its use as a food preservative, and am exceedingly anxious to find all that has been said for and against such use. In my search I met your statement on page 557 of the 1900 Year-Book of the Department of Agriculture and am anxious to consult some or all of the authorities you had in your mind when you said: 'Since 1880 the mass of the evidence resulting from physiological studies with salicylic acid tends to condemn the addition of this substance to foods under all circumstances.' Of course, if the list of such authorities is a long one, I do not wish to impose upon your time by asking so great a favor as it would be to give them all, or even a large number of them. If you will but be kind enough to supply me with even one, or a very few of the references that condemn it in the strongest terms, you will make me very much your debtor."

Ten days later the following reply was received from Professor Bigelow:

"I greatly regret the delay in answering your letter of the 8th instant. Shortly after writing the Year-Book article to which you refer I lost my library by fire and with it the notes consulted in the preparation of that article. I have delayed answering your letter with the intention of looking the matter up because I am sure I can put my hands on several such references, but so far I have not had time to attend to it. I shall do so, however, as soon as possible and write you further concerning the matter."

In February, 1905, or over one year after Professor Bigelow had promised to send the references that he was sure he could put his hands upon, they had not come. The reader will please note the fact that *even one* reference was begged for as satisfying. As Professor Bigelow is Chief of the United States Food Laboratory at Washington, and, as much of his time, during the year 1904, was devoted to experimental work on the physiological effects of salicylic acid, he surely must have looked up, and with great thoroughness, all important literature upon the subject. He surely would not start work of such national importance without having done so. Every up-to-date, modern experimenter knows how essential to good work this is. No true scientific worker ever begins experimental research until he has done this. It is now deemed practically impossible to pursue such work successfully before the prior work of others has been studied. It appears to the author that Professor Bigelow had not only the stimulus of the communication here submitted and his promise of a reply to the same to impel him to discover again the lost references, but much of the success of his entire work of the year 1904 would seem to have depended upon the thoroughness with which he made the hunt. As a representative of the United States Government he ought to have had unusual facilities at his command for finding out all that had been done before him. It is fair to assume that he and his assistants had far more literature to ransack than his burnt-up private library contained.

The coincidence in time between the correspondence and his government work on the same subject was quite fortunate, inasmuch as it ought to have kept him from forgetting his promise concerning sending the references as soon as he came across them again. The fact that after more than a year, and at the end of his work with his so-called "poison-squad," he had not made good his promise, would seem to indicate that no such references could be found. We, certainly, have searched in vain for any such references. Now our interest is centred upon watching for the appearance of the report of his work, which it is to be hoped will correspond with that of others and be unbiased by the opinion which he expressed in such forcible language, but which to us appeared to be so devoid of support. It is an exceedingly hard matter for most men to go back on anything they have published, but we sincerely hope that Professor Bigelow has overridden the "personal equation" and supplied the world with imperishable facts.

When the opponents of modern preservatives fail in their other objections to the use of such substances in food they usually introduce the subject of "personal idiosyncrasy" as a clincher. Brouardel, in the references already made, introduces this phase of the subject, and Bulletin 13 of the Department of Agriculture, Division of Chemistry, on page 300, has done the same. In the British Parliamentary Committee's investigations a number of the witnesses declared that they deemed the matter of great importance. (Blue Book, Questions 5016, 6569, 6749, 6750.)

While there is an appearance of fairness in urging the rights of idiosyncratic people, it is far from fair to forget the greater rights of a vastly greater majority. To suppress preservatives, or to place them under unreasonable restrictions for the purpose of keeping idiosyncratic people from the possibility of harming themselves with the preservatives of preserved foods, would certainly seem to be an infringement on the rights of normal people. Should the attempt be made to be consistent in such a proposal and bills be drawn up to suppress the use of everything toward which certain people have an intolerance we would very soon discover that the public would never tolerate so flagrant interference with their rights.

Dr. H. W. Wiley tells us that "The idiosyncrasies of digestion are numberless. The wise physician does not prescribe an iron-clad diet for all his patients, but he studies each one individually and finds those articles of food which are palatable, nutritious and tolerable. There are doubtless many people who are seriously injured by eating glucose; there are many persons who cannot take a glass of beer without making them ill; thousands of people have been poisoned by pure honey—that is, honey to which no substance had been added other than that placed there by bees. Many stomachs do not bear starchy foods; others cannot tolerate coffee or tea, and so on to the end of the list. But these are matters which everyone knows without further consideration cannot be regulated by Congressional enactment; but what can be secured is that any food upon the market shall not sail under false colors, so that when the physician prescribes a certain article for the use of his patient and that patient goes to the retail grocer and asks for it, he shall be able to get exactly what he demands" (Hearings on Pure Food Bills, 1902, p. 258). On the same subject Professor Albert B. Prescott is quoted as saying: "It is difficult to find two stomachs that are alike, as difficult as it is to find two faces which will look alike, so that we could not distinguish one from the other. From the extreme complexity of the digestive process and the highly organized condition of the human body, it becomes impossible, by chemical analysis, to say precisely what food would be most favorable to digestion and harmless to a given individual. People find by experience. We hear men say every day, 'I can't eat potatoes.' We hear men say every day, 'I can't eat this or that article of food.' The witness who preceded me said that he had been greatly injured by malt liquor made from rice.'" (Ibid, p. 259.)

The utter absurdity of attempting to legislate against substances because of individual idiosyncrasy must be apparent to any reasonable person who is once made aware of the following facts stated by Professor W. O. Atwater: "Some of the compounds produced from the food in the body may be actually poisonous. Different persons are differently constituted with respect to the chemical changes which their food undergoes and the effect produced, so that it may be literally true that 'one man's meat is another man's poison.' Milk is for most people a very wholesome, digestible and nutritious food, but there are persons who are made ill by drinking it, and they should avoid milk. The writer knows a boy who is made seriously ill by eating eggs. A small piece of sweet cake in which eggs have been used will cause him serious trouble. The sickness is nature's evidence that eggs are for him an unfit article of food. Some persons have to avoid strawberries. Indeed, cases in which the most wholesome kinds of food are hurtful to individual persons are, unfortunately, numerous. Every man must learn from his own experience what food agrees with him and what does not." (Dept. of Agri. Farmer's Bulletin, No. 142, p. 25.) The professor lays down the following rule for the guidance of every one in matters of food: "Each person, too, should learn by experience what kinds of food yield him nourishment with the least discomfort, and should avoid those which do not 'agree' with him" (p. 48).

In Gould and Pyle's Anomalies and Curiosities of Medicine, pages 489 to 493, can be found references to a large number of extraordinary idiosyncrasies toward foods of many kinds. Convulsions, syncope, skin eruptions, violent vomiting, abdominal pain, spasmodic asthma, swelling of tongue and throat, with other violent and alarming forms of illness, and in one case even death has occurred from partaking of various ordinary articles of diet. One unfortunate person is referred to who could not endure wheat flour in any form. To most of us this is the very staff of life, but to him it was apparently as poisonous as tartar emetic. The authors tell us that, "If he ate flour in any form or however combined, in the smallest quantity, in two minutes or less he would have painful itching over the whole body, accompanied by severe colic and tormina in the bowels, great sickness in the stomach and continued vomiting, which he declared was ten times as distressing as the symptoms caused by the ingestion of tartar emetic. In about ten minutes after eating the flour the itching would be greatly intensified, especially about the head, face and eyes, but tormenting all parts of the body, and not to be appeased. These symptoms continued for two days with intolerable violence, and only declined on the third day and ceased on the tenth" (p. 492).

To stop the sale of flour, starch, potatoes, eggs, meat, fruits of various kinds and the thousand and one other articles of diet that exceptionally are capable of producing injury to people, is something that it is evident could never be accomplished. To forbid the baker selling cake, into the composition of which entered an egg, would be no more unreasonable than to forbid the selling of food containing a preservative when in each the cause of the prohibition was idiosyncrasy. The placing of absurd restrictions on the sales of foods because they affect unfavorably certain supersensitive people would never be tolerated by the public. Why should such restrictions be placed upon preservatives because of this very same absurd charge? Fairness and honesty demand that if the excuse for the restriction be valid in one instance it should be applied with equal fervor in the other.

Akin to the logic by which preservatives are sought to be proven injurious because they possess preservative powers, the unreasonableness of which contention we have shown in a preceding chapter, is that by which they are sought to be proven poisonous because they destroy germs. In Bulletin 53 of the North Dakota Agricultural Experiment Station we are told that "Antiseptics operate by suspending or destroying the life of these organisms or that of the germs out of which they develop. Antiseptics are, *accordingly,* for the most part, decided poisons." Where the "accordingly" takes effect it would be hard for this author to tell, as it surely does not work with sugar and salt, tea and coffee, cinnamon and cloves, nutmegs and ginger, beer and wine, vinegar and mustard, lemons and oranges, sour fruits of all kinds and a multitude of other antiseptic substances too numerous to mention. Such reckless statements as are made by the enemies of modern food preservatives, of which the above quotation is a sample, are patterned after the political utterances of demagogues. Men occupying responsible, scientific positions in government experiment stations should be educated enough to know better than to write anything like the above. They ought to know, if they do not, that being poisonous to germ life has no connection with being poisonous to human beings. Few would have the temerity to deny that arsenic is a deadly poison to men, and yet Frankland and Ward experimentally demonstrated that it has but little effect on microbes. (Jour. Soc. Chem. Ind., 1893, p. 1053.) Loew showed experimentally that larvæ and infusoria can live in a one in one thousand solution of potassium arsenate, while this strength would kill all the higher forms of life if treated to it in anything like such a proportion. (Loew, Centr. für Agr. Chem., XIII, p. 68.) Pathogenic microbes produce substances of the highest known deadliness to human beings yet practically non-poisonous to themselves. Human beings produce in their blood substances of the most deadly character toward microbes, yet quite harmless to themselves. Of these two classes of substances Salter's Lafar's Technical Mycology, Vol. I, says: "The reaction between the animal body and bacteria is reciprocal. Just as the latter are able to excrete noxious metabolic products, the effect of which on the infected animal body is manifested as disease, so also the former can elaborate substances having a poisonous effect on the parasitic micro-organisms. The normal and continuous presence of such protective albuminoids, or alexines, as they are called, in the blood, is the cause of the natural immunity enjoyed by certain animals against certain species of bacteria" (p. 306).

Two commonly urged objections that frequently do service in trials in court are that the use of preservatives in food may prove hazardous to persons under treatment by the doctor giving them an overdose of that very antiseptic through adding his medicinal amount to the amount in the food and the claim that the medical profession, taken as a whole, oppose the promiscuous use of any remedy by the patients themselves. On ignorant juries such statements have a decided effect, but this is no evidence of their truthfulness. On the principle that all is fair in war, many district attorneys are not over-anxious about the truth of their contentions so long as the jury can be influenced against the accused. If they really wanted the truth instead of a miscarriage of justice they could soon find out these contentions are untrue as applied to such cases. The only doctors who ever approach the maximum doses of any drugs when giving them to their patients are those who watch for physiological effects and never are controlled by doses.

They begin away down in the scale where they know that there is perfect safety, and where a grain or two of an antiseptic would make no perceptible difference, and from this point they ascend toward the maximum with ever-increasing carefulness as they ascend. To such doctors there could be no interference with their treatment or danger to the patient from a preservative. On the other hand, the rule-of-thumb doctors, who prescribe by the book, never go near the maximum with their doses. If they did they would injure or kill many of their patients, for the reason that the dose for one patient is not the dose for another. With even the same patient the maximum dose one day might seriously injure him in another day. Doctors are compelled to feel their way with care long before they reach such doses as would give any decided difference in results from the presence of a preservative in the food taken by a patient. Again, patients that require maximum doses of any drug are not in a condition to be taking food containing preservatives.

As regards the opposition of medical men to the laity taking medical substances in food, or of their own volition, it is safe to say that except among the unphilosophical no such sentiment exists toward substances that are not distinctly toxic. He would be a very foolish doctor who should hold that the public should not be trusted to use sulphur, cream of tartar, manna, senna, licorice, bicarbonate of soda, vanilla, tartaric acid, citric acid, glycerine, salt, sugar, starch, vaseline and a host of other simple medicinal substances. It is only when the untrained public dabble with poisonous and dangerous drugs that willing acquiescence in their conduct is withheld. Spices and essences even are permitted without the slightest feeling that it would at all be the duty of the doctor to interfere farther than to advise moderation in them. Since these are potent antiseptics, and in concentrated form as essential oils, tread on the verge of danger, why should the sentiment of the profession be directed against articles of the same class that are less dangerous?

Reference has been made to "the general practice of adding preservatives to food materials that have undergone partial decomposition or, in other words, practically arresting the decomposition of food at a stage where the generated poison does not manifest itself by the accompanying odor of the more complete decomposition." (Amer. Jour. of Phar., Nov., 1904, p. 547.) It is sufficient to say that this practice is one that is due to the prejudice that has been developed in the public mind against preservatives. There is no need for delay in their use until foods have reached such a stage. When it is known that they have been exposed to warmth the simple addition of a preservative at that time is enough to prevent decay. It is unnecessary to wait till incipient decomposition has begun. Those who wait do so from fear of law or fear of prejudice. Prompt use when known to be needed is required.

CHAPTER IX.

HOW THE USE OF PRESERVATIVES BENEFITS THE POOR.

Is waste of food a virtue to be commended or a vice to be deplored? It seems almost like an absurdity to ask such a question in seriousness, and yet it loses every semblance of absurdity when we see men hauled into court on criminal charges because they have sought to stop unnecessary waste of food in an intelligent manner. The fight against preservatives, when simmered down to its last analysis, is simply a fight against economy, and a fight in favor of costly methods, that raise the cost of living upon the poor. In every instance, where the enemies of preservatives interfere, it is a case in which cheap methods of preserving food are condemned and far more expensive methods commended. There is never an offer of a cheap substitute, never a thought of the additional hardships which they are heaping upon those with scanty purses, never a suggestion as to how the poverty-stricken shall escape the hardships which their measures inevitably bring, and never even an expression of sorrow over the misery which they seek to inflict upon the poor. On the contrary, wholly meritorious efforts at stopping the destruction of valuable food products are condemned, and through false representation the ignorant are taught to look upon those who are really befriending them as if they were enemies. We are told that, "The object of the advocates of the addition of preservatives * * * is for the purpose of making money by marketing products which could not otherwise be sold." (Amer. Jour. of Pharm., Nov., 1904, p. 547.) What if this is true? Is there anything wrong in a dealer trying to market wholesome products that could not but for intelligent intervention be sold. Is not most of the progress of this world made by this very method? The dealer's sole aim may be one of economy. He may have no other object in view than that of saving himself from loss, but that, surely, does not make a vice of his conduct. If he adds preservatives to certain kinds of foods that without such preservatives might have to be consigned to the garbage heap, is it wrong for him to economize in this way? To say that it is, is to confess to a deplorably narrow conception of public economics. Any community that should enforce such a view would have to pay the penalty in high prices.

In saving for himself the merchant or manufacturer, who is thus economical, is saving that which benefits every person around him. Small as these savings may be, in particular instances, they count into millions of dollars in the aggregate. But for this guarding against leaks in business, competition could not pull down prices to the level at which they stand. He who protects himself best against such leaks is the one who can outsell his fellows in the struggle for customers. If a butcher has forethought enough, and knows how to save his trimmings in a condition of freshness, so as to utilize them when he is making Hamburg steak, he can afford to sell that steak at a price that will commend it to the economical poor. Scraps cut from prime roast beef, in order to put it in a shape that will please customers, are just as fresh as the beef from which they have been cut. Small cuttings, made in bringing the weight of a purchased piece of meat to that for which the customer is willing to pay, are every whit as fresh as the main piece from which they have been cut. As scraps no one would be willing to buy these small pieces for home consumption. Chopped up, either alone or with large pieces of meat, they make excellent Hamburg steak. When properly protected from decay they become wholesome, good and salable in this form. The butcher who does not dispose of his trimmings, in this economical manner, will stand but a sorry chance in trying to meet the prices of his competitors who do. The poor are thus the gainers by the lowered prices that such competition brings. To compel butchers to throw these trimmings into the garbage heap would be to compel them to charge every purchaser of meat with the value of his share of the wasted scraps and likewise compel them to charge more per pound for Hamburg steak. Without the use of preservatives economy of this kind cannot be practiced profitably. Chopped meat, unprotected by preservatives, is dangerous to public health. Exposure to dust, to warmth on the counter before being sold, to warmth in the homes of the poor where there are no refrigerators, all contribute to the danger. Not to add preservatives to such food, even when made from the finest tenderloin steak, without a single particle of scrap or trimming material, is a most dangerous proceeding.

Few can appreciate the tremendous loss that is incessantly going on in the handling of oysters and other shell fish, fresh fish of various kinds, and of fruit, because of the prohibition of the use of preservatives. If dealers in fruit were allowed to keep their goods properly protected from decay the sad spectacle of having struggling mobs of hungry men, women and children contending with each other at the dumping grounds of our great cities for the rotten apples, oranges, lemons, bananas and grapes, as they are emptied from the garbage carts, would be far less common. It is pitiful to see these people eat this filth which theorizing health officers imagine is not consumed by anybody. Why wholesome fruit is almost a prohibited article to the very poor will become evident when we come to consider how its wastage raises its price. The brewer, the wine merchant, the cider maker, the maker of preserved fruits of every kind, need have no waste and little or no spoilage if allowed to market *two kinds of goods.* One containing preservatives, to supply the wants of the poor, could be kept and sold at a low price and the other, free from preservatives, sold at present prices. If the latter are unwholesome, as the foes of preservatives contend, then repressive legislation would not be needed to put an end to them. They would soon show that they are injurious if the claim has the slightest foundation in truth. If the poor man prefer to pay the rich man's price for such goods no one would hinder him. Now he has no choice. He must buy the high-priced goods or none. He is frequently forced to pay the high price for the very class of goods that under less prejudice and greater freedom he would get at greatly reduced rates. The freedom of both merchant and purchaser is grossly curtailed, to the positive financial detriment of the entire community.

But for the economical advantage preservatives have over other methods of protecting food from decay there might be a less determined effort on the part of dealers to protect the public from injury and death through the use of decayed food. Cheap as they are, however, when compared with offered substitutes, they are not entirely costless. In no instance are they ever added to increase the bulk of any salable article. Their addition is in no proper sense an adulteration. They invariably cost the dealer more than an equal volume, or equal weight, of the goods to which they are added. Any addition that may be made, beyond the very small amount necessary to stop decay, is always a cash loss to the dealer. There is therefore not the slightest incentive to add too much. It is always to the dealer's interests to add the least amount possible, and none at all if none is required. His sole interest in making the addition, so far as his pocket-book is concerned, is in order to save goods from destruction that would otherwise be irretrievably lost, not only to him, but to the entire community.

Short-sighted ignorance always fails to appreciate the interests of the entire community in the saving of other people's property. It is hard for the illiterate to understand how the burning of a block of buildings in which they have no direct interest can be a real damage to them personally. It is only to the student of political economy, therefore, that this argument can appeal. Whatever lessens the food supply tends to keep up its price. There is less food in the market to compete. If lessened sufficiently a famine would ensue and prices become inordinately high. The effect of a slight lessening is inappreciable, but an immense number of slight lessenings leaves a decided impression upon the market. The stopping of millions of efforts at saving food, that must otherwise be lost, has an effect upon the market like the cornering of grain, of fowl, or of meat, by some powerful capitalist.

Every food commissioner who forbids the use of cheap preservatives on food products actually holds up the market with as great certainty as ever a Leiter or an Armour succeeded in doing. In order to more fully appreciate this effect upon the market of the use of preservatives we have only to clearly understand the immensity of their consumption and the costliness of every substitute now recommended by their opponents.

We are told in Bulletin 86 of the Maryland Experiment Station that "It is not surprising that the traffic in preservatives should have grown so rapidly and steadily from the fact that there always has been and always will be a growing demand for fresh foods of nearly all kinds. To keep many kinds of food products fresh until the poorer residents of our large cities have had a chance to consume them has always been difficult and comparatively expensive, while preservatives have proven to be relatively cheap, convenient and effective" (p. 17). While preservatives are "cheap, convenient and effective," the substitutes offered by the opposition are dear, inconvenient and less effective. In many instances they are prohibitive in cost, absolutely unavailable, or wholly inefficient for the purpose advocated.

Refrigerator cars are all right for the transportation of meat to some places, but they cannot be used to all. They are all right for those who can afford to pay the high price meat must bear that is transported in them. But some meats can be better transported in preservatives. Take the hams that are sent to Great Britain from Canada, Australia, New Zealand and the United States. What would be the effect upon the markets of the world if the use of boric acid or other preservatives was forbidden? Some idea of the extent to which such preservatives are used in this case may be culled from the Report of the British Committee on Food Preservatives of 1901. The representative of the London Chamber of Commerce declared that, since the adoption of the use of modern preservatives on Canadian bacon and ham, "the increase in the trade is enormous." In proof of his assertion he presented to the committee a *certified* statement, from the high commissioner's office, in which it was shown that this trade alone had grown from $300,000 a year to $8,000,000 a year in nine years. When asked what the effect would be if the use of modern preservatives should be forbidden, he replied: "This gigantic trade that has increased by leaps and bounds from Canada in the last twenty years would come to an end, because if we were to prepare the product as we used, prior to twenty years ago, the trade would be absolutely useless to this country." When questioned further, he asserted that many trials had been made to see the effect of stopping borated goods of the kind named, and they had always ended in disaster to the trade. He was firmly convinced that the prohibiting of the use of such preservatives would end Canadian, Australian and American importations. The president of the Liverpool Trade Association testified that if the use of preservatives was restricted in the direction indicated he did not believe the public would be willing to take up meat in its old, salty condition. With the choice before them of meat containing, and other meat not containing, this kind of preservative, he asserted that actual sales showed that seventy-five per cent. of the former was demanded, as against twenty-five per cent. of the latter. Domestic cured meat, without such preservatives, was being passed by, unbought by three out of every four English purchasers. Only one-fourth of the people clung to goods cured in the old way. (British Blue Book of the Departmental Committee on Preservatives, pp. 5 and 6.) When Mr. J. W. Bennet was asked what he thought the effect would be if preservatives were prohibited on ham and bacon, he replied: "It would raise the price somewhere in the region of seventy shillings or eighty shillings per hundredweight, whereas at the present time it can be bought at from forty-four shillings to forty-six shillings." He further added, "You would deprive millions of people of a product which they now enjoy, by a prohibitory price." How little short of a crime it would be to thus deprive millions of poor of a staple article of food. Think, too, of the effect on others besides the British.

Consider the lost wages to American workmen and American farmers by cutting off this source of income. The millions of dollars paid for such produce by British consumers chiefly goes for American, Canadian and Australian labor. Packed in salt the meat spoils and gets fly-blown. To carry bacon and ham under cold-storage would be too expensive a proceeding to consider. But it is not Britain alone to which such American products go. Every civilized, and even some barbarous countries depend to some extent upon American preserved products for their sustenance. To clamor against preservatives here is to encourage opposition to them elsewhere.

Our Consular Report for January, 1904, gives a warning note concerning the stopping of the importation of American fruits and meats into Germany because they contain preservatives. Our Consul points out the fact that even dried fruit cannot be carried from this to other countries without preservatives. He goes on to say that "a serious injury is done to the working classes," and that this injury has such an effect upon the working people of the German Empire that it is expected to "create intense feeling and strengthen the Social-Democratic party" (p. 16). This refusal of Germany to permit of the importation of American provisions, on the plea that they contain preservatives, is a purely political move to win favor with German farmers, who believe that this holding up of the market will bring them higher prices for what they have to sell. Any excuse is good enough if it will only keep out American competition. To get the endorsement of American opponents of preservatives, as they are now doing, is to strengthen their position in crowding to the wall American commerce. Every dollar's worth of American goods kept out of Germany helps raise the price of provisions in Germany and pleases the German farmer, but it keeps a dollar out of America that would have gone to pay American farm and transportation labor. The millions of such dollars that are kept out of our country means that many millions less to compete for American labor with the dollars already being spent for goods consumed at home.

With the demand for labor diminished by millions of dollars wages must decline through the increased competition among working men for the jobs that are left. Let any person try to sum up, in ever so crude a fashion, the immensity of the loss to the commerce of the United States through this misguided and false fight against preservatives, and the results will stagger them. Take our export records of dried fruits of various kinds, of hams and bacon, of dried beef, of corned beef, of sausages and of relishes of various kinds and ascertain the total amounts that are shipped abroad. That all of these articles require preservatives in order to render them marketable, we learn from Bulletin 13, Bureau of Chemistry, Department of Agriculture, pages 1432 to 1441, where we are told by the authors that "We recognize the commercial importance of securing a harmless preservative for certain kinds of food;" that some packers had told them that in curing corned beef "they find it necessary to add some preservative to the curing brine in order to obtain a uniform and satisfactory product. It is said that such addition is especially advantageous in warm, damp weather." They further state that they were "informed that it is impossible to preserve chipped beef in cans in its own color without adding a small amount of some preservative." Then they go on to say that, "For this reason it is claimed that this article is not a commercial possibility without such addition." In regard to sausages they say: "It is claimed by manufacturers that a small amount of some chemical preservative is necessary to keep sausages which are not put up in hermetically sealed receptacles from decay for the length of time demanded by commerce." On page 1441 they show that not only are smoked and therefore preserved meats used for making potted goods, but that further additions of preservatives have to be resorted to by packers.

If all such goods must contain preservatives in order to be commercially successful, do the people of America want a slice of such tremendous dimensions to be cut out of their income? Will they encourage a crusade of pure prejudice that is sure to lessen the income of every one in the United States who depends upon competitive labor for a living? Will they encourage a move that will raise the cost of living not only upon our own poor, but upon the poor of other nations? Nor is there a possibility of compensating either loss. The goods now exported, if deprived of protection by preservatives, could not be put upon our own market so as to lower prices here by added competition. They must, in such a raid, be allowed to decay and become fit only for the manuring of fields. Is it any wonder that the British Parliamentary Investigating Committee, after a long, careful and conscientious investigation of this important subject, declared in its final report that, "The total prohibiting of preserved methods would clearly be likely to be attended with serious results to the public health, in that large quantities of food possessing highly nutritive value might in effect either be withheld from the poorer classes, or be liable to be consumed by them in a condition of incipient putrefaction." (Blue Book, p. xxi.)

The retort that has been made to this conclusion of the Parliamentary Committee, by our American anti-preservative people, is very characteristic. It is in effect that while the British may not be able to get along without preservatives we can. Our people are rich enough to all own refrigerators, to all be able to pay for plenty of ice, to all be able to afford the high prices for goods cared for and transported without preservatives, and to all have constitutions strong enough to defy deadly toxins and ptomaines. We do not need any goods that are perishable imported into our country under preservatives, if their statements are to be credited.

Indeed, they have made it a point to call attention to the French law that permits of the use of preservatives in wine that is to be exported, while prohibiting their use in wine for the domestic market.

The inconsistency that they formerly turned their shafts of wit against has now been adopted by the American opponents of preservatives as being all right. The French knew that certain wines, for which there was a demand in this country, could not be kept under the treatment they were sure to receive while being transported without preservatives. They therefore permitted the use of preservatives in such wines. This was made by the foes of preservatives to mean that French law-makers held that wine containing preservatives was good enough for Americans, but not good enough for Frenchmen. Now our opponents of preservatives hold that boron compounds are good enough for use on British meats, but not good enough for American. Would it be at all surprising if some astute English politician should take this up as an issue among his countrymen to make them favor food products from their own colonies as against the same kinds of products from the United States? It is thus that the interests of the poor are ever made the football of the unscrupulous. It is politics in both Germany and France that seizes on to the prejudice against new things so as to win votes. Are we quite sure that the self-interest of office-holding politicians in our own country does not seek to exalt the importance of what they are doing so as to increase their pay or their glory, and make it necessary for them to join with foreign politicians in methods that injure the poor?

The possible advantages of the use of preservatives for commerce have never been fully developed. The advantages they possess in enabling regions where crops have failed and stock has perished, to secure freedom from famine of fruits and meats, are incalculable. Their ability to preserve such goods indefinitely enables us to keep up our supplies from seasons of plenty to seasons of scarcity. Take as an illustration the saving of fruit.

In Bulletin 66, Bureau of Chemistry, pages 34 and 35, we are told that, "While many manufacturers undoubtedly use preservatives to prevent spoiling subsequent to the preparation of the articles, others use them for the purpose of keeping the fruit until it is worked up into the finished product. The pulped fruit to be used for making jellies and jams is sometimes kept for several weeks after the addition of some sugar, but not sufficient to preserve it, before being worked up into the finished product. When this procedure is followed the use of some form of preservative *is necessary.*" During the British Parliamentary Committee's investigation it was very clearly shown that without such a process as this Great Britain could not be able to produce the apricot and other jams, jellies and such preparations as she does. Goods of this kind are shipped from England to every part of the world. No apricots are grown in England, and in order to keep up supplying the English people, as well as the people of the rest of the world, with such goods they must import preserved fruit pulp from the countries that grow the kinds of fruit they thus put up. To stop the use of preservatives in this pulp would be to stop this industry in Great Britain. Many kinds of fruit grow in countries where sugar is not made. There the fruit is cheap but the sugar is dear. What would be the sense of sending sugar from where it is made and where it is cheap to where it is not made and where it is costly, only to have it shipped back again to its original source, but put up in jams? Would this be sensible economy? If sugar-producing countries wish to use the fruits of non-sugar-raising countries why should the price be raised upon them in so senseless a manner when by the use of pulped fruit the doubling of transportation would be stopped? Are the interests of the poor of such countries not worth considering? If we wish jelly or jam from various kinds of foreign fruits why should we be compelled to pay for the unnecessary transportation of sugar to and from those countries when the mere transportation of the pulped fruit would answer our purpose? But this is not the worst increase in the cost. Pulped fruit can be carried in immense wooden barrels and other economical vessels, while jams and jellies must be carried in numerous glass or porcelain containers of small dimensions. The breakage, added to the great cost of packages and the double transportation of the sugar, run up the prices upon such goods until they become prohibitive for the poor. This is what the opponents of preservatives are working for. Fruit can be pulped in a way that will preserve it in its flavor for an indefinite time. When so prepared it can be shipped into any climate. Regions that do not produce any particular kind of fruit can receive their supplies from regions that do. Seasons of scarcity of a given fruit can have all that is needed carried over from seasons of plenty.

Rideal, in his book on Dinisfection and Disinfectants, gives two methods of preserving fruits for shipment or for indefinite future time. He says: "Salicylic acid is largely used for preventing loss of material, and consequent annoyance with fruit; four to eight grains of the acid to the pint or pound, prevent fermentation in saccharine liquids; and jams, preserves, etc., can be kept for years. 'As a preservative it is best applied in process of preparation. It is advisable to gradually introduce it in the solid state into the boiling mass (but it somewhat readily volatilizes with the vapor of water), constantly stirring, or the acid may be rubbed down with the fruit juice, and then added. In any case the finished product ought not to show any white flocks.' Another mode is to pour over the cold, uncooked fruit the cold salicylated juice of the same fruit, so that the fruit is entirely covered. A cold juice may be made by pressing the fruit, adding to every pound fifteen grains of the acid, heating the juice, and allowing to cool. In this way cherries, plums, etc., can be preserved all the winter uncooked, and are then suitable for pies. The last of the above processes seems better than the others, since almost all of the salicylic acid can be removed by washing the fruit before cooking." For the home market some such plan as one of these given by Rideal would be better than pulping, where the fruit is to be used in making pies.

In shipping fruit, in its perfect form, it is customary to choose imperfectly ripened fruit, since fully ripened fruit bruises easily and then decays. The rotting of fruit while being shipped is a most serious item of loss, and keeps up the price of imported fruit quite materially. It is the bruised fruit and fruit having the rind or skin pierced or wounded that decays. Bacteria and molds attack fruit as soon as it is injured. A single bruised or wounded spot on an apple that has been put into a barrel with perfect apples becomes a centre of infection from which the tendency to rot spreads through the barrel. Packers will not throw away fine-looking fruit simply because they know that it has had a fall and been bruised to an inappreciable amount. They do not propose to be the losers of such fruit when they can ship it off unnoticed by the buyer. After the fruit is delivered they feel no further responsibility in the matter. But that bruised fruit is responsible for an immense amount of loss that is charged up to the consumer. If fruit packers were permitted to use all bruised fruit, all wounded fruit and all fruit that has had a fall, severe jar or other accident that is likely to impair its keeping quality, for pulping purposes, there would be far less rotten fruit in the market. If they were then held responsible for the rotting of fruit during transportation most of such loss would never occur. By the judicious use of preservatives whole fruit can be kept in perfect condition much longer than at present, so that the present waste and loss is almost wholly due to the fact that preservatives are not more freely used. By the use of preservatives much more nearly ripe, and therefore much more wholesome fruit could be brought to the market under the protection of preservatives. All but traces of such preservatives could be washed off before the fruit is used.

In Bulletin 71, of the Bureau of Chemistry, on page 12, we are told that "well-informed persons will, I think, agree to the statement that, on the whole, not more than about 60 per cent. of the fruit actually grown in this country finds its way into channels of commerce in such a manner as to appear in general statistics. If this be a fair supposition, then nearly 100,000,000 bushels of this fruit (apples) are either consumed without having passed through the channels of commerce mentioned above, or go to waste on the farms where grown." The estimated annual output of apples of the markets of the United States is given by the same author as 140,000,000 bushels. He further says: "Perhaps the data in regard to merchantable fruit produced have been collected with as great accuracy in Virginia as in any other State. These data show that our crop of 1897 reached about 281,889 barrels. These figures are not quite high enough for that year, as the total merchantable crop was about 300,000 barrels. Supposing this to have been 60 per cent. of the total crop, about 1,400,000 bushels of apples were produced in Virginia that year. Of this quantity about 600,000 bushels were locally consumed or went to waste." That it has not all, or any large part of the deficit, been consumed by the farmers and owners of orchards, is clear to those familiar with country management of fruit.

Every person who has visited a country orchard and tramped over the bushels on bushels of fruit that have been blown down by the wind, and that the hogs are often permitted to revel among, will agree with the author in his 40 per cent. estimate of what never reaches the market, but will be quite as sure that most of it is wasted. The same author goes on to tell us that in 1896 the apple crop of the United States reached 69,070,000 barrels, or about two hundred and twenty millions of bushels.

During years of great plenty owners of orchards deem it scarcely worth while to try to gather the crop. Prices run so low that they cannot afford to pay for the labor of harvesting. But for the unreasonable opposition to preservatives all of these immense crops could be saved. If merchants were permitted to sell, in every part of the world, goods that had been pulped they could afford to ship this fruit, the unbruised in barrels and the bruised as pulp, to regions where it would command a good price. There would then be no hesitation in paying farmers and their employees for their time in harvesting and something besides for the care of the trees. Now no one dares to pay for such fruit in seasons of plenty since they know that they would be bankrupted, by the rotting, long before they could dispose of it to consumers. When seasons of scarcity of such fruit occur then only the well-to-do can afford to buy it. The price becomes exorbitant, and for the poor prohibitive, because no one dared to use preservatives in protecting such fruit in seasons of plenty and carrying it into seasons of scarcity. The farmer loses his proper remuneration, the merchant loses his profit, the shipper loses his compensation, the well-to-do have high prices to pay, the poor must go without, the hogs and worms can revel in the criminal waste, and all because of biased opinion on the part of a few. Add to these hundreds of millions of bushels of apples that are lost to the community every decade. the hundreds of millions more of peaches, apricots, quinces, pears, plums, grapes, gooseberries, currants, oranges, lemons, pineapples, etc., and the cash value of the loss becomes so vast that it is appalling.

In the matter of grapes the loss is probably less than with any other fruit since crushed and partially decayed grapes can be converted into brandy. and this used as a substitute for other preservatives in preserving wines from decomposition. After all this waste of fruit from rotting it may be thought that only the best quality reaches the market, and that therefore the public health is guarded against the consumption of little that is unwholesome. That this is not the case was brought out by Mr. J. B. Howard, microscopist in the Bureau of Chemistry, Department of Agriculture, at the Hearings on the Pure Food Bills before the Committee on Interstate and Foreign Commerce of the House of Representatives, in 1902. He testified that in his microscopical examinations of preserved fruits he found fungus plants in abundance. He said "The mycelium, which corresponds to roots in representatives of the higher order of plants, I found had penetrated through the fruit coats, showing that the work had been done before the plant had been put up in preserved form. And furthermore, the fruit, after it had been put up, had undergone no decomposition so far as the microscope could reveal, this mycelium or fibre passing through the tissue being in all parts of the preserves." (Hearings, p. 133.) After exhibiting a number of specimens and photographs of what his microscope had shown, Mr. Howard continued: "Such cases as that of fungus growth, and especially of that kind of fungus, do not take place except in the case of decomposition of the fruit. Then another fact which was noted, and which I shall call to your attention, was the presence of immense numbers of yeast cells. This seems to make the case even worse than the first, inasmuch as decomposition not only had taken place, but fermentation had begun before the plants had been preserved and put up, since these plants, the fungus and the yeast, will not grow under the conditions of sweetness which we usually find in preserved fruits. And another thing, showing that those cells had developed before the fruit had been put up, is the fact that in almost every case the yeast cells were in twins. In the yeast, as it ordinarily occurs, there are chains of cells, sometimes eight or ten of these little oblong, egg-shaped bodies, joined end to end; but in the preserving process these chains had all been broken up, and here we have samples of yeast cells, usually composed of the little tiny cell at the end—the last cell, grown—attached to one another. Then wondering, furthermore, in regard to this abundance of yeast and mycelium, we have secured from time to time various specimens of fruit products, especially the berries, and we find that there is but very little.

if any, of the mycelium and the yeast present in the good and perfect fruit. This would indicate that those growths are on those specimens, just as I said before, in which decomposition has begun and fermentation has followed the decomposition" (p. 134). When asked the question as to whether the fungus growth that he found in so many specimens of preserved fruits was in the fruit before it was preserved, or before it was picked, he replied: "No, sir; not necessarily before it was picked. If it was in that condition, the chances are three to four that the fruit would have been discarded at once. The fruit placed in the boxes had been allowed to lie there in the heat, or otherwise, until this fungus developed. The time required for the fungus depends upon temperature very largely. Some forms are developed in twenty-four to forty-eight hours. In the series of samples which we examined of fruits, that were undoubtedly first quality, of the preserved and marked specimens, out of eight samples I found very little, and in some cases none at all of these fungus and yeast forms which I have mentioned" (p. 137).

When the officers of our Department of Agriculture take pains to show this condition of things in our canned, preserved, and jellied fruits it does not seem to occur to them that the only way that a stop could be put to it would be the granting to the public the privilege of having such preparations made from pulped or antiseptic treated fruits in which the fruit would not be permitted to reach such a stage of decay before being properly cared for. They acknowledge that preserves, of the kind described, are not likely to be very wholesome, but, perhaps, they think fungi-laden fruit more wholesome than the same food containing a small amount of a preservative. There would be little or no temptation to put upon the market, in any form, fruit that has rotted if the great bulk of the fruit we produce was antiseptically protected from the time it is removed from the trees, bushes or vines. To repeat, again, what has already been insisted upon, all the fresh fruit could be afterwards washed and nearly entirely freed from the preservative.

Present methods put a premium on the dishonest palming off upon the public of decayed food because no means is provided for the economical disposal of such goods by their protection before decay sets in. The prohibiting of such care tempts the owners into trying to save themselves from financial loss by these dangerous and unjust means we now complain about. Does any reasonable person suppose that it can ever be possible to detect more than a minute fraction of the cases in which decayed and unwholesome fruit is used in making preserves and jellies as long as the present method of suppressing preservatives is pursued? Could the most drastic law conceivable ever put a stop to it? We think not. Nor can repressive measures, costly as they are, ever entirely rid the market of the multitude of cheap imitations that are here because pure and good fruit is forced into destruction. The millions of bushels of rotting fruit and the tons of bogus jams and jellies are the direct outcome of the repressions of law coupled with the repressions of prejudice. The fruit that is permitted to rot should be in the glasses and cans that are mere colorable imitations of fruit, and they would be but for the agitators who oppose the only conditions that could possibly bring the two together.

In the Twenty-second Annual Report of the Connecticut Agricultural Experiment Station we are told that "jellies were found to consist of starch paste sweetened with glucose," and that "disregarding the value of the package, the four imitations cost only one-tenth as much per pound as the genuine jellies." But this is not the only sort of inferior substitute to which the public has been driven. Dried fruit is soaked, flavored, sweetened, and canned to take the place of pure fruit. Bulletin 66, Bureau of Chemistry, says: "This grade of goods is far inferior to canned fresh fruit, but finds a ready sale, at a relatively low price, in bad fruit years" (p. 93). And this is part of the penalty that the public is forced to pay in order to adhere to salt and smoke, that being good enough for their grandfathers is good enough for them. Pulped fruit, that could be made to keep a lifetime, while possessing the aroma of fresh fruit, would be far more agreeable, far more wholesome, and in time would become far cheaper than these made-over dried products, and about as cheap as the bogus starch-made ones. The fact that the pulped goods please the palate to a much greater extent than these dried-fruit substitutes or starch-made articles makes them much more wholesome.

On this point Professor Atwater, in his Principles of Nutrition and Nutritive Value of Foods, says: "Things which please the palate stimulate the flow of the digestive juices; for this reason food should be made appetizing. An attractive diet pleases the æsthetic sense; hence refinement in food habits is as desirable as in other phases of our daily life. The sense of comfort and satisfaction produced by even the appearance of food well cooked and served is of indisputable value." (Farmer's Bulletin, 142, pp. 47, 48.) It is in order to have this stimulation to the palate that the rich are willing to go to great expense in having perfectly flavored foods. We have shown how the enemies of preservatives punish the poor with unwholesome, high-priced, and often bogus goods under the pretence of getting pure food, how they keep down the wages of the poor by cutting off labor from the market, and how they encourage and facilitate the wanton waste of food products. It now remains for us to show how they also rob the well-to-do and rich of a high-grade class of goods which they desire. In Bulletin 66, Bureau of Chemistry, a gentleman who informs the public that he does not favor preservatives is compelled by the facts to make the following confession. He says: "There is, however, a certain line of *very high-grade* preserved fruits that seem to be demanded by the people in good circumstances, in which *it is necessary* to use a very small quantity of preservatives. This is owing to the fact that the goods are demanded in glass. They are entirely filled with sugar and sunk in a sugar syrup. These goods at this time in the year will keep, but in the Southern climate or during hot weather *they will not keep*" (p. 100). The italics are ours.

CHAPTER X.

PRESERVATIVES AND THE TEMPERANCE QUESTION.

So well known, and so universally conceded, are the evils of intemperance that any general discussion of this subject here would be quite superfluous. But when we are asked, as a nation, to choose between an increase in the use of alcoholic beverages among our people or an increase in the use of preservatives, it might be well for us to recall some of the penalties that must accompany a choice of the former. That such an alternative has been offered us will appear as the reader peruses this chapter. Dr. Lewis D. Mason, in a paper on "The Relation of the Pauper Inebriate to the Municipality and the State," read before the American Medical Temperance Association, on June 8, 1904, gives tables of statistics that show that one-half of the total arrests made by the police forces of New York, Chicago, Philadelphia and Boston are cases of intoxication. He further shows that, according to the Boston statistics for 1898, the mere cost of making the arrests, without considering board and maintenance, was one-eighth of the total cost of the entire police department. The doctor says "that inebriety is the fertile source of crime, pauperism, insanity, and disease. At least four-fifths of the criminals and degenerates of a community may, according to English statistics, be traced to this cause, either directly or indirectly. Facts go to demonstrate that it is an important factor as a cause of suicide, disease, accident, and adult male death from accident, and either directly or indirectly explains the mortality statistics of our great centres of population, especially among the adult male class, in excess above the normal death rate in an ordinary sober community." (Journal of Inebriety, October, 1904.)

A recent writer in the London *Lancet* has shown that "The enormous indirect loss from alcoholism by the ways of sickness, and idleness, and imprisonment, and general inefficiency, brings no gain to anybody. Until this stupendous waste of money and the power to earn money is greatly diminished a very large part of the working classes must be more or less dependent upon charity in times of sickness." (Gaillard's Med. Jour., Feb., 1900, p. 871.) Dr. J. M. French says that "Tatham's tables show that, taking the average mortality from consumption at 100, that of publicans is 140, of brewers 148, and of bartenders 257." (*Medical Examiner*, Dec., 1901.) For every two average men of a community that die of consumption, according to this, five bartenders meet this fate. Delearde found that animals treated with alcohol become less resistant to tetanus and anthrax. They lose the immunity of prior vaccination. If treated with alcohol during vaccination they acquire immunity slowly. He found it impossible to produce anthrax immunity while alcohol was being taken. (Amer. Year-Book of Med. and Surg., 1899, p. 702.) Dr. Felix Formento, at the Buffalo meeting of the American Public Health Association, declared that "Abuse of alcoholic drinks is a powerfully predisposing cause to consumption." (Med. Rev. of Rev's., Oct. 25, 1901, p. 927.) Here we see that experience among physicians, experiments with animals and statistics of crime, all conspire to prove that the excessive use of alcoholic beverages is most decidedly adverse to public health and the public weal. The fact that absolute suppression is not called for, in view of such experience and such facts, is proof that a majority of the people favor personal freedom. Like Prof. H. W. Wiley, they "believe it is the inalienable right of every human being to eat what he likes, to eat it as he likes, and color it as he pleases, and to drink what he wants, to drink without any let or hindrance from any human being, provided he does not offend his neighbors or the laws." (Pure Food Hearings, 1902, p. 216.) Whether we happen to be prohibitionists or class ourselves among those who hold that there should be no interference with our rights to eat and drink what we please, if done decently and in order, few, if any, would dare to deny the fact that the abuse of alcohol brings expense and suffering upon everybody. This being the case all ought to agree in the conclusion that no effort should be spared, compatible with honest individual liberty, in lessening this monster evil. Certainly we should not, as a people, encourage anything that tends to increase drunkenness. To frame our laws in a way that will increase the temptation to become drunkards surely cannot be considered wise legislation. To interpret laws, in which there is room for a doubt regarding the meaning, in such a way as to compel us to favor intemperance, is hardly a form of interpretation that works for the public good.

At the International Tuberculosis Congress, of 1901, Dr. P. Brouardel said that any measures tending to limit the ravages of alcoholism will be the most precious auxiliaries in the crusade against tuberculosis. (*British Medical Journal,* July 27, 1901.) If he is right, then any interpretation of law that encourages intemperance tends to bring death and cruel suffering from the worst of human maladies, to an increased number of our fellow citizens. The Act of Congress making appropriations for the Department of Agriculture for the year ending June 30, 1905, contains the following: "The Secretary of the Treasury shall refuse delivery to the consignee of any such goods which the Secretary of Agriculture reports to him to have been inspected and analyzed and found to be dangerous to health." How is this passage of the law to be interpreted? In Circular No. 18, of the Bureau of Chemistry, we learn that "Products will be deemed injurious to health in the absence of contrary judicial determination: (a) If any substance, with the exception of the long-used, well-known condimental substances, viz., common salt, spices, sugar (sucrose or saccharose), wood smoke, and vinegar, be added thereto for preserving, coloring or other purposes, which is injurious to health, either as determined by actual experimental evidence or in the predominating opinion of health officers, hygienists, and physiological chemists. (b) If the products be decomposed, filthy, decayed, or in any unfit condition for human consumption" (p. 2). Here there is evident intent to rule that preservatives are injurious to health. In making an exception in the case of the long-used, well-known condimental substances there is a virtual claim that even these are harmful, but out of respect for their antiquity they are to be tolerated in imported goods.

There is another "long-used, well-known condimental substance" that is employed as a preservative, but which has not been enumerated in the excepted list. How shall it be treated? We refer to alcohol. Whether this article is present in whisky or brandy it is the same identical substance. The gentleman who signs Circular No. 18, and who, presumably, has put this interpretation on the law, upon another occasion is reported as having said: "Do you suppose there is a single food commissioner who is a prohibitionist who would not decide that whisky is an injurious article to health? And he would be backed up by nearly the whole medical profession, and that, too, in the 'quantities used or intended to be used.'" (Pure Food Hearings, 1902, p. 205.) As health officers, hygienists, and physiological chemists are nearly all members of the medical profession, are we to conclude that brandy or whisky, as preservatives, shall not be permitted to be used in any article imported into the United States? Surely if nearly the whole medical profession would support the contention that brandy or whisky are injurious to health, this must be the predominating opinion of health officers, hygienists, and physiological chemists, since they are of that profession. On reading the two pages, that follow this interpretation of what the law means by being "dangerous to health," we observe that wine, whisky and brandy are to be admitted, regardless of their effect upon health, if they only conform to certain requirements regarding quality. Upon the same occasion, when the gentleman referred to was discussing prohibitive laws, he said: "Aside from the fact that the latter class of laws is discriminating, there can be no objection to their enactment, provided the deleterious effect of the prohibited ingredients were established beyond any reasonable doubt." (Hearings, p. 225.) It appears from the free admission of these beverages, notwithstanding the fact that nearly the whole medical profession deems them injurious, he, at least, doubts that their deleteriousness has been "established beyond any reasonable doubt." On page 3 we find that *fortified wines* are not to be excluded. Since the brandy that is added to these wines is put there simply and purely as a preservative it "is added thereto for preserving" and should come under the ruling. Whatever the future rulings may be in regard to preservatives any ruling that permits of the admission of fortified wine is not a ruling that will contribute to the public good. If it is to be dealt by in so liberal a manner there cannot be a shadow of an excuse for excluding from our country goods containing any of the ordinary preservatives, unless by some accident an amount in excess of that necessary for their preservation has been added.

One of the most pronounced inconsistencies of those opposed to the use of modern food preservatives is their failure to oppose the fortifying of weak sweet wines. The sweet wines are, as a rule, those most commonly chosen as an occasional beverage by people who rarely indulge in alcoholic drinks. They are the wines most frequently given to children. The fact that such wines contain a large percentage of sugar makes them require either an added preservative or an unusually high proportion of alcohol to make them keep. In a number of countries laws have been passed forbidding the use of any preservative other than alcohol in wines of this kind. What sort of effect could any reasonable person expect to be produced from a law of this kind? Can any person conceive of a more captivating method of inducing the drink habit than this, or of inducing it upon more unsuspecting persons than upon innocent children? How is a fondness for strong drink better established, among beginners, than by causing the insidious imbibition of larger quantities than should be taken at a time? Is there any conceivable way that can beat an unsuspected over-indulgence in alcohol for fastening the drink habit on a person?

Dr. Francis E. Ainstie, editor of the London *Practitioner,* says: "A bottle of twelve glasses of average port is equal in alcoholic strength to rather less than half a bottle of brandy, or two bottles of good claret or hock, or nearly a gallon of table beer." (Uses of Wines in Health and Disease, p. 12.) How many of those who choose port because of its sweetness are aware of this fact which Dr. Ainstie here points out? When drinking a glass of wine with a friend, for the mere sake of being sociable, the non-indulger turns to port, sherry, or madeira, because their sweet taste is much more pleasant to his uncultured palate. His friend, being in the habit of taking wine at his meals, calls for claret, burgundy, Rhine moselle, or Hungarian wine. The novice tries to drink enough of his wine to bring himself within a reasonably close quantity to that consumed by his friend. It never occurs to him that in each glass he is taking there is nearly twice as much alcohol as in the glasses drunk by his friend. He probably observes that while he is becoming affected by it his friend, who, perhaps, drank three glasses to his two, remains quite sober. He explains to himself this difference by assuming it due to the fact that his friend is more accustomed to drinking than he is. It never dawns upon him that he has really drunk more alcohol in his two glasses than his companion did in the three he took. Parents, not knowing this difference, when serving wine to company, give to the grown-up boy or girl what they think is half the quantity served to adult guests, or taken by themselves. The children select the sweet wine, and the half-glass they get is equal in alcoholic strength to nearly that of the full glass of claret chosen by the guests. To most Americans wine is wine, and they know nothing of the difference in strength of one wine as compared with another. In wine-growing regions such knowledge may become familiar to the public at large, but in much of our country it is not so.

There is still another danger in these sweet wines. Dr. Ainstie tells us that there is a common idea that they are "particularly suited to healthy adult life, and especially to middle age." This he believes to be a complete mistake on the part of the public, and adds: "The vigorous frame and perfect digestion of a healthy young or middle-aged person requires but a moderate daily allowance of alcohol to assist functional activity, and as, nevertheless, the temptation to free indulgence in the pleasures of the table is most influential in the middle period of life it is of the greatest consequence that the alcohol should be taken in the most diluted forms." (Uses of Wines in Health and Disease, pp. 18, 19.) The temptation to give this class of wines to children, and the further temptation that is an outgrowth of the superstitious notion that such wines are particularly suited for healthy adults to take, makes of them the drag-net that hauls into the ranks of intemperance the very persons who require protection from strong drink. The trouble with sweet wines is that they require a large proportion of alcohol in their composition to make them keep. A small amount of another preservative would do just as well.

Nature has supplied our whortleberries (huckleberries) with benzoic acid and wintergreen berries with salicylic acid (as methyl ester), presumably to stop the rotting of such berries in their damp environments. Why do we refuse to take this lesson from nature? Either of these preservatives would keep sweet wines in as perfect condition as could be desired without the addition of extra alcohol. The distribution of these two substances so widely in the vegetable kingdom can be no mere accident. The fact that they are found in fruits and flowers where seed and pollen are exposed to the attacks of fungi must have some meaning. The fact that they only appear when seed or fruit are bruised, or that they appear in greater abundance then, indicates that injury produces the occasion for their usefulness. The relatively large amounts found in fruits, from the order Ericaceæ, whose environments are known to be favorable to the growth of fungi, lends additional weight to the inference. When we have a choice between the use of these preservatives, that nature has approved for millenniums, and a preservative that will certainly encourage drunkenness, it should not take long to decide. Even if we grant that alcohol, like salt and smoke, have been sanctified by the approval of our barbarous ancestors, it does not follow that this is a greater commendation than nature's acceptance of the others through a still greater antiquity. The latter, by the way, are nature's antagonists to the production of alcohol. The berries containing them cannot be made into wines without their removal. Is it because they are antagonistic to alcohol production and aids to temperance in checking the consumption of alcoholic beverages that some people oppose them so strongly? Sweet wines, before being fortified, are already too strong in alcohol for the public good. Why then add more of an article that common sense cries out against the addition of? It is contrary to human interests, degrading to the nation that permits of its practice, and should be denounced as criminal by every right-thinking person. Those who favor such a practice while opposing the use of modern preservatives are like the Scotch burglar who denounced his fellow burglar for whistling on Sunday morning as they were returning from a successful haul in a neighboring house. "Jock! Jock! dinna whustle on the Sabbath!" is the exact spirit of their opposition. They do not think of the wrong that is done in supporting and encouraging conditions that tend to debauch the race, but they keenly perceive a feature that runs counter to their early bias, however innocent it may be in itself.

In Bulletin 72, Bureau of Chemistry, Department of Agriculture, we are told that "Wines of the port type are manufactured on the same lines followed in southern Europe: that is, by fermenting the juice down to about 6° to 10° sugar and *fortifying* it up to 20 per cent. alcohol. A great many manufacturers try to keep their alcohol below this number, *which is a mistake.* Any dealer who wants to age a wine of this kind that is over three years *should never store it away under 22 per cent. in alcohol.* Wines of the sherry type are made by fermenting white must down to about 4° of sugar and *fortifying* up to about 20 to 21 per cent. of alcohol." Regarding the Tokay type, he says: "These wines are produced by allowing the grapes to shrivel on the vines, becoming partly raisin, and *fortifying* up to 20 per cent. alcohol, the same as with the sherry type" (pp. 38, 39). We have added the italics in this quotation so as to show the encouragement we, as a nation, are giving to this unnecessary and demoralizing habit of adding more alcohol to wines containing too much alcohol, when we consider who are its chief consumers. Here is an official publication of the United States Government telling wine makers that it is a mistake for them to try to keep down the alcoholic strength of wines, that are excessively strong in that substance, merely because the author thinks they will keep better if more is added. What of the effects upon the consumers, since many of the consumers are little children? What of the fact that such sweet wines are most likely to be used as communion wines in churches where unfermented grape juice is not used? Permit the use of harmless preservatives in these wines in minute amounts and fortifying becomes wholly unnecessary.

Let us next turn to the examination of what still another department of our government is doing in the way of helping to manufacture drunkards, and that, too, from the very best elements of the country. In Volume IX of the Twelfth Census of the United States, for 1900, we read that "The production of brandy by wineries was reported as 114,185 gallons, of which 60,785 gallons were from California. This, however, is *only a small fraction of the entire brandy product* of the State, which approximated 3,000,000 gallons, of which *more than* 2,000,000 gallons were used *for fortification of wine,* and not separately reported. * * * The internal revenue tax of $1.10, which is collected on each proof gallon of distilled spirits, *does not apply* *to brandy used in the fortifying of wines,* or to that deposited in bonded warehouses until it is withdrawn therefrom. According to the report of the Commissioner of Internal Revenue for the fiscal year ending June 30, 1900, 2,137,067 gallons of grape brandy were used in the fortification of angelica, port, sherry, Tokay, muscatel, and other varieties of sweet wines. This quantity was added to 7,544,342 gallons of wine, producing 8,815,441 gallons after fortification" (p. 627). Is it to encourage the use of extra alcohol as a preservative that our government remits millions of dollars of its internal revenue, and this to produce conditions that tempt the flower of our population into drunkenness? If, as we have been told, any measure tending to limit the ravages of alcoholism is the most precious auxiliary in the crusade against tuberculosis, then this remission of the tax on brandy used in fortifying sweet wines is an auxiliary of that grim reaper Death in his harvested victims of the great white plague. The traffic in alcoholic beverages needs no such encouragement as this. A more injurious means of getting rid of this revenue-free brandy cannot be conceived.

Nor is the United States the only country that sins in this direction. For many years France has encouraged this same evil practice. There the effects are being keenly felt by the best citizens. In October, 1903, a congress was called in Paris to deliberate upon means to eradicate to some extent this growing scourge. Our Paris consul reports that "The feeling with regard to the peril of France was voiced by Dr. Debove, dean of the medical faculty, in his opening remarks before the National Anti-alcoholic League, at a meeting in Paris, during the latter part of October. He spoke as follows: 'I gladly accept the honor of presiding over your meeting. In the face of the peril which menaces us no one has a right to refuse his support, for we have the disgrace of ranking first among alcoholic nations.' * * * Official statistics bear witness to the unfortunate truth of this statement. France has 465,556 saloons to supply the wants of 38,666,366 inhabitants. That is one saloon to eighty-three inhabitants, and this number is constantly increasing." (Monthly Consular Report, March, 1904, p. 663.) We are not very far behind France in this direction. The report of the Commissioner of Internal Revenue, for 1903, showed an increase of 7,127 liquor dealers in the United States over the number of the preceding year. If we keep up such a pace we will soon beat the world. There are over 200,000 licensed saloons in this country to supply a population of a little over 80,000,000, or one saloon to every four hundred. This, however, includes women and children. For about 15,000,000 voters there is a saloon for every seventy-five. Could results of any kind different from these be expected from countries that deliberately rob their taxpayers in order to let wine growers produce beverages that will convert the unsuspecting into lovers of strong drink? Nor is this the sole evil they produce.

The medical profession has long known that sweet and fortified wines are an immediate cause of gout in families having a gouty tendency. Dr. Ainstie, who has made a special study of this phase of the subject, informs us that he has "personally sought in vain for any instance where the moderate use of a really non-saccharine sherry has produced gout." (Uses of Wines in Health and Disease, p. 28.) All of the cases that came under his observation were induced by using sweet wines. Here a remarkable coincidence is to be observed in that the antidote to gout is the very preservative that is most suitable for use in such wines. How much better it would be for the users of such beverages if they contained less alcohol and had, instead, a small amount of the substance that their constitutions require to carry off the superabundance of uric acid? Such a combination would provide for them, in the same draught, both bane and antidote. But this is not permitted. Even foreign goods are now stopped at the custom house and sent back to where they came from, if found to contain this preservative. By Act of Congress, of August 15, 1894, Section 68, fortified wines are permitted to enter, and even wines that have been adulterated with substances never found in natural wines can come into our country without let or hindrance. The substances referred to are, of course, mentioned among "the long-used, well-known condimental substances" of the new ruling on the Act of June 30, 1904.

Even the very latest of the Food Definitions and Standards, of the Committee of the Association of Official Agricultural Chemists, defines and fixes a standard for these fortified sweet wines. "Fortified sweet wine is sweet wine to which brandy has been added," is the language of this latest form of legislation by proxy. The standard reads: "Standard fortified wine is fortified sweet wine containing not more than twenty-four (24) per cent. of alcohol by volume." We have here evidence of the fact that the Association of Official Agricultural Chemists agree with the author of Bulletin 72, of the Bureau of Chemistry, and have outdone him in his claim that it is a mistake for wine makers to try to keep their sweet wine below 20 per cent. alcohol. He told these manufacturers that they should never store such wine away under 22 per cent., but the committee expects some of it to at least reach 24 per cent. This is bringing the wines that mothers administer to their children well up toward the poorer class of whiskies and more than double the strength of some clarets. It really looks as if some of the Official Agricultural Chemists of this country needed the attention of the advocates of temperance.

In order to supply summer drinks that are non-alcoholic and pleasant various preparations sweetened with sugar and flavored with fruits, essences, or herbs, have been introduced. As every solution of this kind quickly spoils during warm weather it is quite impossible to impart keeping qualities to them without sterilizing or supplying them with preservatives. There are many practical difficulties in the way of sterilizing such goods, and even when it is successfully accomplished their exposure to the air renders them quickly perishable. When a beverage of this kind is once opened it must be quickly consumed or thrown away. The work of sterilizing, the cost of bottles, and the loss of any not quickly consumed, all add materially to the cost of such beverages. If forced to depend entirely upon such method of preservation the poor would have to use water only. Doctors Macalister and Bradshaw, of the Royal College of Physicians, London, after a careful examination of the problem of preservatives, said that their need "Is largely due to a commendable desire on the part of a large proportion of the public to have wholesome and agreeable beverages free from the risk of the moral and physical evils which too often attend the use of alcoholic drinks." This statement is confirmed by the report of the British Parliamentary Committee on the Use of Food Preservatives, where they state that "Of the temperance beverages received from all parts of the United Kingdom, 83.5 per cent. of those sold as temperance 'wines' and cordials contained preservatives." (*Lancet,* March 14, 1903, p. 720, and British Parliamentary Committee on Preservatives' Blue Book, p. 13.) In this country the most popular summer drink is sodawater. Where this is drawn directly from the fountain and the syrups added subsequent to the drawing there is no need of either sterilizing or preservatives in the water. The fruit juices, however, except when made directly from the fruit by the owner of the fountain, and just before using, must either be kept sterilized or with preservatives. The sterilized fruit juices are never as perfect in flavor as those protected by preservatives, and they cost more. Here the dealer is compelled to pay a higher price for a poor article than he would have to pay for a good one. Besides this he must use up, immediately, all of the fruit juice in his opened bottle, or throw away the part he has not trade enough to consume. At every step, as the reader perceives, every substitute for preservatives adds to the cost and puts an extra burthen upon the consumer. The merchant with a large demand for sodawater can use up an entire quart bottle of fruit juice in a day. It is no hardship to him to use sterilized fruit juice except where it enables his competitor to give a better-flavored article because of using a juice containing preservatives. Where fresh fruit is used the cost is very much greater but the product better. The rich can afford ten cents per glass for sodawater flavored with freshly crushed fruit. The middle classes can afford to pay five cents per glass for an inferior flavored and sterilized preparation, but prefer to pay this amount for one containing fruit juices kept by means of preservatives. The very poor are at the parting of the ways. Sterilized fruit juices will carry the price of a glass of sodawater above the three cents per glass at which they can now often get it. For an inferior article they will be compelled to pay five cents per glass. Naturally many of them will prefer to buy a glass of beer at the same price. This will carry them into saloons and pave the way for their downfall. If, instead of going into the saloon to drink, they send the tin pail for their beer, another difficulty confronts them. They cannot economize on beer any more than on sodawater. If they get more than enough to satisfy their thirst, as it is free from preservatives. they must throw away what they do not then need or else drink it all up. Who can guess how many times boys and men have made themselves tipsy trying to drain a keg of beer to its dregs, when they have clubbed together to buy in an economical fashion? If it would keep there would be less danger of swiftly being carried to the stronger drinks. When they become accustomed to the physiological effects of alcohol and begin to desire the same then they go to stronger drink and become drunkards. There is another phase of this part of the subject. The beer that is sent out from the brewery is less likely to contain a small proportion of alcohol where preservatives are not permitted. They must introduce preservatives or have an increase in the amount of alcohol to make the beer keep until sold. In warm weather and with beer that goes to a distance, if low in alcohol it will quickly become unfit to drink.

The processes of sterilizing and pasteurizing of perishable liquid foods and beverages was at one time highly commended by the opponents of preservatives. Slowly they are learning a few facts in this field of knowledge, and are becoming less sanguine of these being the ideal methods of protecting such goods from decomposition. Already they have abandoned their claims in some kinds of goods, and it is only a matter of time when they will learn that they will have to give them up regarding others. Early in their attack upon preservatives they insisted upon our drinking sterilized cider. Makers tried it again and again only to give it up in despair. Bulletin 71, of the Bureau of Chemistry, now tells us: "Sterilizing the must by heat.—The process is mentioned *only to condemn it,* so far as cider making is concerned. *Not a single maker* worthy of credence in the factories visited abroad recommends or uses this method. * * * Heating or pasteurizing to check fermentation or insure keeping of cider is also just as faulty." The reason given for its abandonment is that it gave a cooked, disagreeable taste to cider that it was impossible to cover up. During the British Parliamentary investigation regarding preservatives, a member of a large firm of manufacturers of cider was asked if they used salicylic acid as a preservative of their cider, and what he thought of pasteurizing as a substitute. He replied that the firm to which he belonged used the preservative named and that they had tried pasteurizing very extensively, but that so far from its working well they had found that it would not answer at all, since it made the preparation insipid, flat and unsalable. He begged the committee not to decide against preservatives, because his experience had proven to him that in cider, at least, they are public necessities without which the users of this article would be compelled to consume a decomposed or an unpleasant and insipid preparation. (Parliamentary Committee's Blue Book, p. 256.)

In the case of milk the medical profession discovered very quickly that when this article is sterilized or pasteurized it works havoc among sick babies. Why it does so has not yet met an adequate explanation, but there is no mystery in the fact that the chemical composition of the milk is very profoundly altered nor of the further fact that children who use such milk are injured by its use. On this subject the *Philadelphia Medical Journal* said: "Sterilization being injurious to the milk is at best a necessary evil." (Feb. 2, 1901, p. 223.) On the same subject Dr. J. Winters declared: "Pasteurizing of milk is the direct cause of a large number of cases of scurvy in children of well-to-do parents. Scurvy was an unheard of disease among infants before sterilized foods were introduced." (Cin. *Lancet-Clinic,* Feb. 8, 1902, p. 153.) In confirmation of what Dr. Winters tells us, Dr. L. Fisher says: "I want to emphasize the fact that the sterilization and pasteurization of milk is an additional evil." (Ibid.) On the same page the editor of the *Lancet-Clinic* remarks: "So far from bringing about a better condition, the sterilizing of milk has created a disease that was unknown a few years ago." Dr. Stark, in 1895, was among the first to point out the serious injury that the sterilizing of milk was bringing upon infants. (Reference from Munch. Med. Woch., No. 42, in Year-Book of Med. & Surg., 1897, p. 548.) Many health departments and medical societies, misled by the advocates of sterilization, who were also the opponents of preservatives, encouraged the use of sterilized milk, and some went so far as to establish sterilizing plants where the poor could secure supplies at low rates, and in extreme cases gratuitously. Now the medical societies of New York, Brooklyn, Boston, Philadelphia, Buffalo and other large cities have withdrawn their support of sterilized milk and transferred it to what is called certified milk. Committees of these societies, after inspecting dairies and their surroundings, and after learning how certain dairies are conducted as regards scrupulous cleanliness, certify to these facts in behalf of the dealers. (Diet. & Hyg. Gaz., Aug., 1901, p. 494; Brooklyn Med. Jour., May, 1902, p. 238.) So convinced was our Department of Agriculture of the blessing of sterilized milk that under the approval of the Secretary of Agriculture, Circular No. 1, of the Bureau of Animal Industry, was issued on December 19, 1893, and a revised edition on November 15, 1897, giving full directions for a simple and economical method of converting a tin pail into a sterilizer for home use.

The matter of pure milk for the aged, infants and invalids still remains an unsettled question and one worthy of the most serious consideration of the best intellects of the world. As milk constitutes the *entire diet* of infants, and frequently the entire diet of invalids, its protection by the use of any now known preservatives becomes a matter of doubtful propriety. As we have already shown the effect upon the human system of foods, preservatives, or medicines is a matter of proportion and of dose. If all we eat and all we drink is made to contain full preservative doses of any preservative it is evident that the quantity imbibed would be very much more than if only one-tenth, one-twentieth or one-fiftieth of our food and drink contained such preservative. If everything we ate contained one grain of a benzoate or salicylate to each pound and everything so drank contained one grain to each pint a person who ate and drank liberally might take in as much as four or five grains at a meal. While this is below the usual dose given in acute rheumatism and only one-tenth of the maximum, still it is too much to keep taking over long periods of time. To put the sick on a diet of milk containing medicinal amounts of a remedy that may not be indicated as necessary in their case would be rather irrational. But what should be done? In the present stage of our knowledge of the subject the certified-milk idea is the best at our command. Anything that will tend to keep milk up to the highest degree of freedom from contamination by germs needs encouragement.

Milk is a necessity of civilization. Many lives are absolutely dependent upon it. Ignorance on the part of dairymen, farmers and milk dealers has caused more Rachels to weep for their children than all the Herods that ever lived had power to cause. Europe and America have been swept by epidemics of scarlet fever, diphtheria, measles and consumption that have been clearly traced to the milk supplies. Summer complaints are the annual visitors that the milk can brings to nearly every home that has a baby. Recent bacterial research shows that much of this is perhaps due to a superstitious idea inculcated in the mothers by their advisers. The investigations of Bienstock (Archiv. für Hygiene, Vol. XXXIX, 1902, p. 390) have shown that lactic acid producing microbes possess the power of destroying the germs of putrefaction, as well as other pathogenic microbes. As fast as the lactic acid germs develop in milk so fast do the disease-producing germs disappear therefrom. Disease germs require a neutral or slightly alkaline medium in which to grow. Milk in souring gets rid of its most dangerous germs. Mothers have got into the habit of adding lime water to milk. They have been advised to do so. Some of them add baking soda. This keeps the milk alkaline or neutral, but permits of the multiplication, at a tremendous rate, of the germs of putrefaction and disease. This attempt at prolonging the sweetness of milk by the addition of alkalies is many fold more dangerous than adding preservatives. If the milk is not absolutely fresh any attempt to prolong its period of sweetness will not keep it fresh. If allowed to sour it would become disagreeable, but in no sense as dangerous as is a protracted sweet period. Bienstock's investigations have since been confirmed by many others, among these being Tissier and Martelly. (Annales de l'Institut Pasteur, 1902, p. 865.)

While the sterilizing of cider and of milk have been abandoned as worse than useless procedures, the habit of sterilizing or pasteurizing of fruit juices, other than those of the apple, has been continued. Where our experience was extensive enough to put the practice to a thorough test of its effects upon health, and where conditions favored an early discovery of the ill effects, the inevitable abandonment has occurred. Where circumstances make the exposure of our ignorance concerning nature's methods difficult those who formerly favored pasteurizing of every perishable liquid now insist upon the pasteurizing of the general run of fruit juices. They deem this discredited method better than using a minute amount of the very article that nature herself has put into nearly every kind of fruit. As these juices are the flavoring ingredients of nearly every temperance drink, and as unfermented grape juice is the temperance man's substitute for alcoholized wines, it is worth while to look up the meagre supply of facts already acquired as to how pasteurizing affects these. Every chemist knows that the cooking of fruit juices, even at temperatures below the boiling point, must change their composition profoundly. When thus cooked they certainly should not be permitted to masquerade as pure fruit juices. A sterilized, or pasteurized, grape juice has a composition quite unlike that of a true grape juice. It contains altered chemical substances that do not exist in the juice of any grape that ever grew, and it lacks in its composition other substances that the juices of grapes always contain. When a cow converts grass into milk it alters the composition of the grass very profoundly. When the pasteurizer cooks his grape juice he alters its composition in a somewhat analogous fashion. The chemical difference between pasteurized grape juice and the juice as it comes from the grape is, in some of its constituents, quite as great as between milk and grass. When grape juice is fermented into port or sherry the changes it has undergone are less profound, so far as the beginning and end results are concerned, than are the changes that occur in pasteurizing. If fermented wine is to be discarded for sacramental purposes because the original wine claimed to have been used for this purpose was the unfermented juice of the grape, then this modern product of cooked wine would seem to be farther from the original in chemical composition. In olden times they had both unfermented and fermented wines, but we have no record of their using cooked wines.

In Farmer's Bulletin, No. 175, of the Department of Agriculture, we are told that, "The effects of unfermented grape juice on the human system have been studied for a number of years, especially at the so-called grape cures so long in vogue in Europe. A smaller number of investigations have been made in laboratories. It is quite generally claimed that using a reasonably large amount of unfermented grape juice with an otherwise suitable mixed diet is beneficial and that digestion is improved, intestinal fermentation diminished, and that gains in body weight result. It should not be forgotten that the abundant and hygienic methods of living practiced at the grape cures play an important part, but even taking all this into account it seems fair to conclude that some of the good results can be directly attributed to the unfermented grape juice. Grape juice contains the same kinds of nutrients as other foods. The percentage of water is high, and thus it resembles liquid foods more closely than solid foods. It is sometimes compared with milk, the most common liquid food. It contains less water than milk, more carbohydrates, and less protein, fat and ash. Carbohydrates, largely present in the form of sugar, are the principal nutritive ingredients. It is evident, therefore, that grape juice is essentially an energy yielding food, and may help the body to become fatter, though it cannot materially assist in building nitrogenous tissue" (pp. 13, 14). It is important to note, in this connection, that the cures of the grape juice used in such places as are here referred to, are not accomplished by the use of cooked juice, like that which the opponents of preservatives are pushing forward, but with unchanged juice, and this cannot be secured out of the season of grapes or away from vineyards without the use of preservatives or the far more expensive method of refrigeration.

As unfermented grape juice and beverages made from or flavored with various fruit juices constitute the chief temperance drinks, their composition should not be subjected to any changes that decidedly reduce their nutritive value. Yet this is just what pasteurizing does. The most valuable constituents, the nitrogenous part, are those in which decomposition is most certain to occur, and these constituents are coagulated, precipitated, and thrown out of the composition of all these juices whenever treated in this manner. The author just quoted directs farmers how to proceed in order to make their sterilized grape juice clear. He advises them to filter off the nitrogenous precipitate (pp. 8, 9). Although grape juice only contains from two to three per cent. of this flesh-forming material, many makers of unfermented, pasteurized grape juice filter it off and throw it away so as to have a clear and more salable product. Others put it on the market in its unsightly and unappetizing appearance. As thus marketed its very looks detract from its value as a food. Physicians are not generally aware of the fact that pasteurized grape juice has had its chemical composition so profoundly altered or that samples that look clear have been robbed by filtration of their most valuable constituents. All reports of benefit to the sick from grape juice have come from those who have used a juice containing its living principles and not from one in which these principles have been coagulated, precipitated and filtered out. Just as the white of an egg hardens by heat, so the living and essentially life-giving matter of grape juice forms a coagulum on heating which permeates the juice as a cloud and gives it an unpresentable appearance. To filter this away is to remove what was its very best part before it was cooked, and to leave a mere concoction in water of acids, sugar, coloring matter and ethers. Even the latter are injured. The whole mass is essentially the same as an artificial preparation. A laboratory imitation of a pasteurized grape juice can easily be produced, but a laboratory imitation of genuine, unsterilized grape juice is beyond the power of man to produce. What would be thought of the man who should try to dispose of whey filtered from its curd as pure milk? That is just the sort of trick the man is guilty of who pasteurizes and then filters his fruit juices. To sell curdled milk as fresh milk is the same in principle as selling pasteurized but unfiltered grape juice as the genuine juice of the grape.

Fruit juices contain important ferments that aid digestion and assist the body in ways not yet fully understood. These are all destroyed by pasteurizing. In a juice like that of the pineapple we know that pasteurizing destroys its bromelin. In regard to grapes we have not yet ascertained the kind of ferment, or ferments, they happen to contain. We do know, however, that the lecithin is destroyed. Of this *La Nature* says: "Those who affirm and those who deny that alcohol has true food value agree that certain nutritive substances may be found in alcoholic drinks. * * * To these, however, has now been added a food of great value, namely, a lecithin—one of a class of substances recently found to be especially promotive of rapid growth. * * * As lecithin alters at about 50° to 60° C. (122°-140° F.) the so-called pasteurized wines lose this precious principle during the heating." (Translation in *Literary Digest,* Sept. 3, 1904, p. 289.)

When pasteurizing is thus found to injure grape juice, injure fruit juices and injure milk; when continuous refrigeration is not always possible, but is always very expensive; when sweet wines must have their alcoholic contents materially increased, in order to make them keep; when laws are passed to foster this means of manufacturing drunkards, and when non-alcoholic summer beverages—the beverages of temperance people—are about to be converted into luxuries for the rich, it would seem to be about time to protest against the baseless theories that are responsible for such serious conditions. When foods are forced to remain the carriers of acute poisonings and acute diseases; when millions of dollars' worth of property, that could be saved, is annually condemned to destruction; when commerce is being hampered, harassed and checked; when the wages of the poor are being pulled down by the narrowing of the sphere of their work; when the food of the poor is being raised, and necessities converted into luxuries by the artificially increased cost of keeping such food, and when all this is due to the determined opposition of a few men who are clinging to the discredited opinions of a generation ago, it might seem as if so gigantic an evil could readily be removed. Unfortunately the public is slow to learn. Busy men feel as if they could not afford the time to study the facts and draw their own conclusions. It is much easier to accept the word of others, and with those others it is easier to believe what their fathers believed than to accept facts that feelings make them want not to be true.

CHAPTER XI.

PRESERVATIVES AND LEGISLATION.

EVERY attempt that is made, through legislation, to adjust human conduct to equity deserves the warmest support of every intelligent human being. As civilized life increases in complexity new conditions are constantly arising where new limitations must be put upon the members of a community to keep the aggressive from overstepping the natural boundary line that marks the point where their freedom must end in order to grant equal freedom to all others. The golden rule of Christianity is the fundamental principle of all laws that are just. No law should exist upon our statute books that deviates from its spirit. A law that seeks to enforce a principle which is not equally applicable to all classes and all individuals of the same class is not in accordance with that rule and is therefore unjust. He who seeks to do unto others as he would have others do unto him never wants a law passed that injures others where, if he was in their place, he would not be quite willing to endure such injury.

Only where the good to the many overshadows the injury to the few will any just man ask for the passage of a law that injures any human interest. Legislation prohibiting the use of preservatives, or restricting their use in a way that is practically prohibitive, can only be excused on the ground that such prohibition, or restriction, does more good than harm. If the immense damage done to the tens of thousands employed in industries where food preservatives are used, by the passage of laws checking or destroying these industries, is less than the good that is done to the multitudes who use the products of such industries, then it must be conceded that such laws were justified. If no evidence is forthcoming of any such good then there is no justification for such laws. They are tyrannical and should never be tolerated by a free people. It is the duty of those who support and defend such legislation to show, in some tangible way, that the good accomplished is adequate compensation for the injury wrought. To attempt to defend such legislation on vague suppositions and *a priori* reasonings is to do no more than tyrants have often done. An appeal to popular fear has ever been a weapon of tyranny.

One of the most successful tricks of tyrannical legislation is that of putting words into laws that carry an implication of odium and then making the same laws define such words in a way to smirch with that odium things or conditions that never before bore such odium or masqueraded under such a meaning. Every dangerous attempt at sumptuary legislation, and, for that matter, all attempts at legislating in a manner calculated to circumvent constitutional rights, resorts to this trick. By stretching the meaning of a word it is easy to read it into a law in a way to elude public vigilance and in this way gain the support of people who would otherwise, on principle, oppose it. In food legislation the method of those opposed to preservatives is to have their bills so constructed as to forbid adulteration. No reasonable man can oppose legislation that wishes to put a stop to adulteration. Adulterated foods, in the sense in which the public understand these words, deserve to be legislated out of existence. Those who palm off on the public foods of this kind are as much swindlers and robbers as are three-card-monte men or burglars. The common meaning of the word adulterant, and the one in which the majority of people understand it, is a cheap or worthless substance added to a dear or valuable one in a way to lower the value of the latter so that the purchaser shall not know that he is being robbed. The man who adulterates goods of any kind does so in order to increase his profits at the expense of his customer. No one can justify such conduct and every man who practices it should be behind prison doors. But the enemies of preservatives have had laws passed making more than this adulteration. "Food shall be deemed adulterated, within the meaning of this act, if it contains any added substance that is deleterious or injurious to health, etc.," is the common wording. Then they go on to tell what shall be deemed injurious to health. In this way they have pushed back into the shade of two definitions their intent to rob the friends of preservatives of any chance to get facts before the public. No friends of preservatives are willing to put themselves on record as opposed to adulteration; neither are they willing to defend the use of things injurious to health or that are unwholesome, but, by the trickery of their enemies, they are made to appear, to the general public, as if doing both.

Recent laws, in some of our States, have sought to practically reverse the ordinary meaning of the word adulterate so that it is now possible to convict a man on the charge of adulterating because he has added a dear and valuable substance to a cheaper one for the purpose of improving its quality. To improve the keeping qualities of a food by the addition of a preservative, even when the preservative is far more costly than the food itself, is branded as an adulteration. The one who adds the preservative has no fraudulent intent when he adds it. He does not aim at debasing the goods, but on the contrary he aims at keeping them in perfect form and appearance, as well as quality. When brandy is added to sweet wines in order to give them keeping qualities no one attempts to call the brandy an adulterant of the wine. There is not an element of what is recognized as adulterating present in the use of modern preservatives that is not equally present in the fortifying of wines. If the one is an adulterant then the other must be the same. They are not adulterants in the sense that they seek to debase the goods or because the seller wants to rob somebody. They are not adulterants in the sense that the buyer gets less value for his money than he thinks he is getting. The sole distinction between the two cases, making the one an adulterant and the other not an adulterant, is the dislike of the framer of the law to one and not to the other. He wrote into the law a prearranged definition that made preservatives what they are not, without the formality of giving them a defense. The law thus constructed assumes that the users of preservatives are adulterators without a trial. It assumes them guilty without the formality of a hearing. It denies them the slightest redress and the slightest opportunity to prove their innocence. It is a mere caricature of justice. In their eagerness to oppose the use of preservatives the framers of such laws have adulterated and debased the English language and diminished its lucidity by stretching its meaning. Laws of this kind save a lot of trouble in trying cases. It takes the time and labor of courts to find out what constitutes right and wrong, justice and injustice. This kind of law does away with all such necessity by leaving judges and jurors no other option than to condemn. They might not decide in the way the constructor of the law wanted them to do if he allowed them to study the evidence of harmfulness or harmlessness of these substances, and so he decides it for them in advance. Is this in accordance with the tenets of civilized justice? How would it do to construct all other laws in this way? Honestly constructed laws having an honest intent need no such devices. If preservatives are injurious attack them on their demerits and forbid their use as preservatives and not as adulterants. It would be just as easy to call them preservatives, in the law, as to call them adulterants, and certainly far more honorable. If preservatives are as bad as claimed there should be no need of trying to hoodwink legislatures or the public by the production of laws of this strabismic type.

In most legislation seeking to subdue preservatives, instead of endeavoring to get words conveying some definite idea, the words usually chosen are among the most indefinite available. The word poison, while far from being a definite one, represents an idea that is fairly definite. There are a number of articles that are pretty universally acknowledged to come under the designation poison. One would think that in drawing up a law, of a prohibitive character, regarding the use in food of certain substances, that there should be no resort made to any words less definite than this. What, however, are the facts? In most legislation dealing with preservatives the word *poisonous* has been introduced. When we come to discover that everything we eat and drink is fairly deserving of this title, when used in certain amounts and in certain ways, the indefiniteness of such a term becomes apparent. When we reverse our view, and discover that in certain other amounts and ways of taking nothing deserves the title, the indefiniteness is emphasized. When we observe that every individual, in accordance with his beliefs and opinions, modifies its meaning, so that what one person deems harmless, or essential to comfort and happiness, another deems poisonous or injurious, we soon discover that such a word is among the most uncertain in its meaning of any in the English language. In a general way they all may agree that poisonous signifies having qualities or effects like those of a poison. It is used to describe such substances as possess less potency than strychnine, arsenic, prussic acid, or such like toxic agents. It applies to everything which, in any degree, possesses noxious powers upon the body. Since all substances, in undue proportions, possess such powers its range of meaning must cover practically everything. We all know that an undue amount or proportion of butter taken with our food will exert just such an influence upon us. The same is true of sugar, as many a child has discovered when it has made itself ill with an excess of candy or other sweets. Salt in excess is likewise poisonous. A law that forbids, under penalties, the use of poisonous substances in food aims well but shoots crooked. Such a law must necessarily leave the interpretation of the meaning, or intent, to the jurors. An educated jury will interpret it in accordance with its knowledge of injuriousness. An uneducated jury will give it a quite different meaning. A jury having a faddish dislike to certain substances will construe the law to mean those substances, in defiance of evidence to the contrary. Except by an accident justice cannot be expected to win under such a law. If the intent of just legislators is to be properly executed only words having fairly definite meanings should be used. General and vague expressions are subversive of justice. The more restricted the meanings of the words used in laws the less likely is justice to miscarry.

A recent bill before Congress contained the following sentence: "That for the purposes of this act an article shall be deemed adulterated, in the case of food, if it contain any added poisonous ingredient which may render such article injurious to health." Whoever wrote this sentence of the bill did not intend to forbid the use of butter, sugar, mustard, spices and a multitude of other substances that enter into our daily food, yet a fair interpretation means just this. Whether anything is poisonous or not poisonous is a mere matter of dose. No substance is poisonous in itself. None is poisonous or injurious to health if the amount used is within the limits of the body's power to dispose of it. The most dangerous and deadly substances are perfectly harmless if the dose taken is small enough. Poisons are such because their doses are very small. Keep even these within the limits of the body's power of disposal of them and not the slightest injury can come to the most delicate human being from any of them. There are a few substances that, like the salts of lead and mercury, can unite with some tissues of the body and by accumulating in the body, in this way, can exceed a proper or safe dose, though being taken in small doses. There is one substance known that decomposes within the body into another substance the dose of which is very much smaller than its own. It is this that makes wood alcohol so dangerous. By being converted into formic acid in the body its power for harm is enormously increased. Substances having the qualities here referred to seem, on superficial observation, to be exceptions to the rule enunciated. Their power for evil becomes greater than would be expected from their doses. They, however, obey the same law, as all other substances in this respect.

The notion that a poison is a poison in any dose *is a superstition.* The notion that certain substances are deleterious in all doses and under all circumstances is one that belongs to the ignorant past. The danger of certain substances if used as preservatives resides in the fact that their doses that are safe are too small for use by careless or ignorant handlers. The use of a substance having a small dose incurs great risk. The smaller the dose the greater becomes the risk, other things being equal. A stupid or ignorant person could be trusted to sprinkle upon food an article with a dose as large as that of salt, but to trust such a person to put upon food an article with a dosage one-fiftieth of that of salt would increase the danger, of a blunder, fifty-fold. On the other hand, if the preserving power of the article is small, so that a very large amount of it is needed, another element of danger creeps in. A stupid person would be likely to go a little beyond the preservative dose and tread upon the medicinal dose. If the quantity needed as a preservative was small it would not matter much if a doubling of the proper amount happened to occur. No substance should be used as a preservative if its medicinal dose and preservative dose are nearly the same. The larger the amount necessary to keep down germ development the greater becomes the danger of the consumer reaching or passing the medicinal dose. If one-fiftieth of a medicinal dose of one substance is enough to preserve a pound of food, while it takes three-fourths of a medicinal dose of another, then the first is nearly forty times more safe than the second. Singularly enough the opponents of modern preservatives, because of the erroneous notions they entertain, hold to the opposite view. To their peculiar mental vision the dangerous one would be deemed nearly forty times more safe than the safer one. Of course they do not draw such conclusions from the dosage, but from the belief that great protective power means great danger to digestion.

Any substance can with perfect safety be used as a food preservative; (1) if it has a maximum dose of not less than twenty grains; (2) if it requires no more than from one-tenth to one-twentieth of the amount of its maximum dose to properly protect one pound of food from decomposition under the ordinary conditions to which such food is likely to be subjected in commerce and in the household; (3) if it has no tendency to accumulate in the tissues of the body; (4) if it does not decompose while in the body into a substance with a much smaller dose than its own. Public health can be maintained with perfect safety under regulations that will allow any substance to be used as a preservative that answers these requirements. Regulations of this kind place upon them limits that are natural, safe and fair. Laws based upon principles give no room for indefiniteness, support no prejudices, and serve no private interests that are not at the same time public interests. In rule one (1) the twenty grain limit may not be satisfactory to every person, but objectors should be willing to state just what dose they think would be better. If they wish to place the limit at ten grains or five grains let them give their reasons for the choice and not send us to sea without a rudder by refusing to name any dose. If they think thirty or forty grains would be better let them state why they think so, and let those passing the law that seeks to enforce the principle determine the most satisfactory dose. Fix a dose—any dose—so that the matter is definite and not left entirely to settlement upon the basis of whim and injustice. In rule two (2) if one-tenth, or any fraction between that and one-twentieth, is unsatisfactory to any interest, let it be known and let the legislators fix a fraction that will be satisfactory. The main thing is to get some fixed standard. In placing such a standard there should be no exceptions. Spices, salt, sugar, smoke, and every other preservative should be held rigidly to the same requirements. Age should count no figure in justice. To construct laws upon principles of this kind leaves no room for doubt concerning the intent of the legislators and does not delegate to irresponsible persons a power that legislators alone should possess. But for a deep-rooted superstition that exists in the public mind to the effect that there are in existence substances that are inherently unwholesome or poisonous there would be no trouble in getting these principles embodied in law. The fact is that no single chemical body can be injurious, poisonous or unwholesome to our bodies in any other sense than these rules regulate. Germ-laden food can multiply poisonous and deleterious ingredients within the body, but it is precisely for the purpose of protecting us from such unwholesome, deleterious, self-multiplying danger that preservatives are used. To confuse the cure of such a danger with the cause by supposing that preservatives can be deleterious in this dangerous manner is a grave mistake.

There is absolutely nothing inherently injurious in substances the dose of which is kept below the limit of minimum medicinal effect. Alcohol becomes injurious when enough is taken to produce the slightest toxic feeling. The moment its peculiar effects are recognized in consciousness by the taker that moment the limit of perfect safety has been passed. Below that point the organism disposes of it without altering the even currents of the circulation or effecting any change that is not normal. The same is true of all substances other than foods that contain self-multiplying and poison-producing germs. Poisonousness, unwholesomeness, injuriousness, deleteriousness and noxiousness as applied to definite substances is a mere matter of dose. There does not exist in nature any known substance in which such qualities inhere when they are diluted to a point below and at which they produce no symptoms upon the taker and do not accumulate in his tissues.

The notion many entertain that the advocates of the use of preservatives in foods want them used on all sorts is a wholly erroneous one. On the contrary, we know of no advocate of their use who thinks it would be right to use them with promiscuous lavishness nor on any goods that can be better or more economically cared for without them. Preservatives can never take the place of cold-storage where cold-storage is practical or possible. Foods containing preservatives can never take the place of fresh foods that have been properly guarded against infection of micro-organisms. Preservatives are entirely unnecessary in canned goods the contents of which can be thoroughly sterilized by heat without damage and that are usually subject to immediate consumption as soon as the cans are opened. Foods cured by drying require no preservatives where they are not exposed in damp climates and are kept away from moisture.

Modern preservatives can never wholly supplant the older preservatives. Salt, smoke, vinegar and alcohol will hold their own against all newcomers in every form of food in which the public prefer them. No one modern preservative can wholly fill the place of any other. Each has its allotted field of usefulness, so that the fear of possible injury from their use, because of overdosage, is wholly groundless. There is not the slightest chance for any human being ever swallowing, upon his food, any such amounts, of any preservative, as was given to the so-called "poison-squads" during the experiments of the Department of Agriculture at Washington. No one adheres continuously to the same diet, so that if a man happens to get a little boric acid in something he has eaten to-day, a little salicylic acid in something he eats to-morrow, and a little sodium sulphite in something he eats on the succeeding day, there is no such daily consumption of any single preservative as is assumed to take place. If there is some continuous dosage as with boric acid in butter or of salicylic acid in catsup, the amount is so infinitesimal that it would take weeks of such dosing to get as much as can be safely given at a single dose and repeated four or five times a day. The conditions of advancing civilized life necessitate the use of preservatives to guard the public health at points of danger where the public are now left to the tender mercies of chance.

Everybody knows that occasions arise before, during and after transportation by cold-storage when the food is left unfrozen for a time. It may not be often. It probably occurs with somewhat greater frequency than do its startling results of toxin and ptomaine poisonings. The germs that produce these poisonings do not develop in properly protected provisions that hav been continuously under cold-storage. Somewhere during transi from the slaughter-house, or the cannery, to the consumer the has been a delay, under warmth, during which the virulent ger gained such ascendency. Somebody knew of this intermission in the application of the cold. The law forbade his saving human life and suffering. If he had been permitted—or, better still, compelled—to use a proper preservative, no one would have suffered from the accident. He knew when a carload was side-tracked, with an accident to the refrigerating apparatus, but refused to lose the load. He knew that no meat inspector could tell that anything had happened to the meat. From his viewpoint the best thing to do was to refreeze it and send it ahead as if nothing had happened. Had he been held responsible for every case of poisoning by his provisions and been permitted to save himself from the danger of such cases arising by using preservatives on all detained goods, there would be fewer deaths and fewer cases of agony from such neglect. The amount of meat that would have to be protected in this way could be but a minute fraction of his total shipments, but it would be enough to save many a family from mourning over the unreturning dead.

There are many regions so remote from cold-storage transportation that it is but a mockery to ask them to depend upon cold-storage provisions. Without the use of preservatives their food supplies are cut down to such goods as can reach them without decomposition. There are regions where large amounts of perishable foodstuffs are or may be produced in great abundance, but no cold-storage facilities connect them with the larger centres of population. The goods they produce, and that might be consumed by others, can gain no egress because of the opposition to preservatives. They are forbidden the use of goods they need, but that cannot reach them without preservatives, and they are forbidden to send their products to others because they will not keep without preservatives. The law is their enemy in both directions. Goods transported under cold-storage gain, through such laws, an absolute monopoly of the markets which they can reach. If the same goods could be marketed under treatment with preservatives no such monopoly would be possible. Let the people have a choice and the provision trusts will be less formidable. To give the cold-storage system absolute control of every market in the country is to rob the poor and benefit the rich. To give it control is to check the development of every region which it does not reach without materially benefiting the regions which it does reach. The fruits of the tropics could be shipped in better condition than now and the consumption vastly increased if gathered nearly ripe and packed in preserving materials. The fear of the law and the fear of a false public opinion that has been fostered by the erroneous notions of our fathers keeps down the development of the fruit business along proper scientific lines. The present exacerbation of this conservative spirit is going to the extreme of forbidding the use of preservatives in relishes of various kinds and in fruit juices where the amount any person is likely to consume is so minute a fraction of the smallest medicinal dose that the whole opposition is verging on the ridiculous, even as viewed by many opponents of preservatives.

So long as the exposing of fish, fowl, vegetables, meats and other perishable foods, on counters, in wagons, and on street stands, is permitted, goods of these kinds ought to be protected by preservatives. It would, of course, be better to stop this habit entirely. Until it can be stopped the law should not only permit but try to compel the placing of some sort of cover over them and prescribe some definite amounts of preservatives to be used, in accordance with the nature of the goods. Cold-storage meats, when sold as perfectly fresh meat, should be kept, when on exhibition, under glass and in a frozen condition. If any butcher wished to exhibit it in an unfrozen condition it should be protected by preservatives. Butcher shops often become infected with special poison-producing germs that persist for months and sow disease on every piece of meat that is placed upon their counters. All such shops are subject to the changing of their bacterial flora with each change in stock. When a very dangerous kind comes along that butcher in whose shop it gets the best chance to multiply becomes a menace to the whole community in which he resides and, unfortunately, he will be utterly unconscious of the harm he is doing. Even his victims may never know how they came to be among the ailing. Refrigerating show cases or the use of preservatives are the only alternatives for the protection of the public, but those who should look after such matters forget these real dangers while hunting after imaginary ones.

A recent cry of the opponents of preservatives has been "Let the label tell." This when translated into its full significance means that all goods containing preservatives should bear a label informing the purchaser of the fact that preservatives are present in such goods in certain quantities. We have little doubt but that the labels on goods of this kind would long ago have told the fact but for the misrepresentations of the foes of preservatives. They have for years kept up an earnest propaganda of denunciation and misrepresentation that has tended to frighten the uninformed and make them believe that those who put preservatives in foods were worse poisoners than the Borgias. Unknown to themselves they were often living evidences of the falsehood of their own teachings. While taking preservatives in foods, the presence of which they did not know, they were trying to make out that to take such was to produce ill health. Their health was as good during the entire period of their unconscious experimenting and the health of the whole civilized world averaged far higher during the quarter century in which everybody was taking them than ever before. Had they made the attack upon them fairly and honestly, on the grounds of their dislike to taking things they did not want to take, they would have had a good case and the author of this volume would have been heart and soul with them in defense of their rights. By all means let the label tell, and in order that justice may be even-handed let those who want the label to tell be as honest on their side and avoid misrepresentation. Let them tell no more than facts. Let them cease making statements that cannot bear investigation. As consumers of food products they have a perfect right to know what there is in the food they are eating, but they have no right to state things that are not true in order to create prejudice and dislike to the things the label tells about.

In demanding that the label tell the contents of the package do not have laws passed that compel the label to tell what is not true. Some have gone so far as to compel goods to bear the word "Adulterated" before the name of the article. Whoever got such a law passed must have known that, in the case of preservatives, such a label was calculated to deceive and prejudice the consumer. It never was intended to bear the truth to the minds of the readers. One has to go back to the old days of heresy hunting to find a parallel to such zealous ignorance. In the olden times a multitude of people held that it was their duty to protect their fellow-beings from adulterated truth. They declared that heresy was poisonous, unwholesome and injurious to the mind. Let the reader note how close the analogy has become. The very words used in the old persecutions are the exact words of the new. The arguments of the old are of a piece with the arguments of the new. The cause in the old was the dislike to the introduction of change in mental food. The cause in the new is the dislike to the introduction of change in the physical food. The method of opposition in the old was to abridge the rights of the whole community by the enactment of laws restricting their liberties. The method of opposition in the new is to repeat exactly that of the old. The defenders of the old were earnest in their endeavors to protect the dear public from having their mental health impaired by the continuous effects of heresy. They thought that it might not show its bad effects immediately, but that when continued through long periods of pernicious teaching it undermined the mental health. They did not see the deadly microbes of superstition and immorality that their suppression was encouraging. They did not see that they were fighting the only possible cure to the mental corruption and moral degeneracy that was going on around them. Neither do the opponents of food preservatives see that they are but repeating that old fight upon a new plane. That which the modern opponent of progress denounces as poisonous is no more poisonous than was that which the ancient opponent of progress denounced as poisonous. That which the modern denounces as unwholesome is no more unwholesome than was that which his prototype called unwholesome. The so-called pernicious, injurious and deleterious of the opponents of preservatives are no more pernicious, injurious and deleterious than were those of the heresy hunters of the past. These latter wrought up the imaginations of the masses to such a pitch that heresy was deemed the worst of sins and the heretic was considered the worst of criminals. Horrid and unjust as was the persecution of the past, the present crusade is but its reproduction on a minor scale.

THE END.

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